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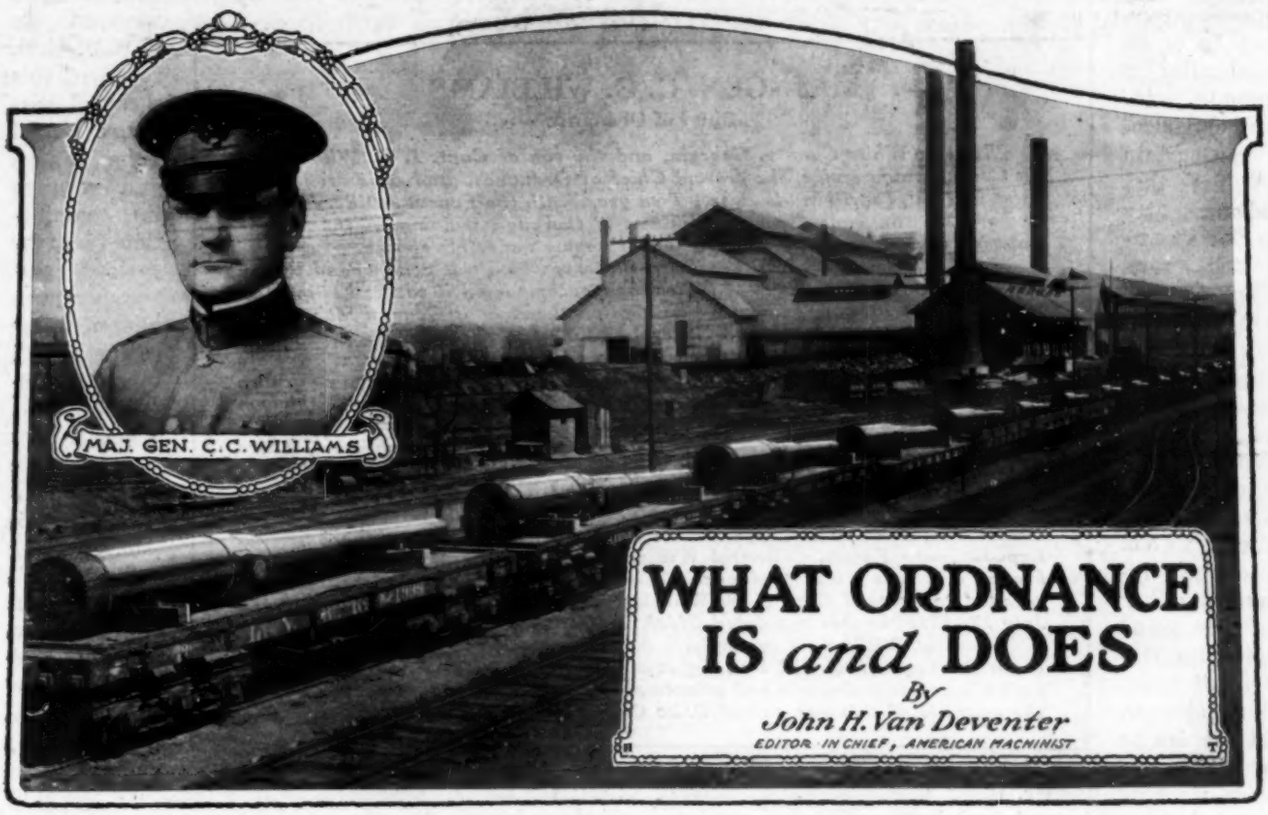


WHAT ORDNANCE IS *and* DOES

By
John H. Van Deventer
EDITOR IN CHIEF, AMERICAN MACHINIST

WHAT is ordnance? The battlefield can best answer that question, for it is the battlefield alone that justifies and necessitates the existence of ordnance. A storming battalion is going over the top. The men have their steel helmets and hand grenades and their bayonets are fixed to service rifles. They will manipulate these ordnance arms for victory. The officers, automatic pistols in hand, go forward fearlessly to meet the Hun. Smoke and phosphorus grenades are being thrown into suspected dugouts, forcing their coughing and choking occupants, hands up, into the open air. Some of the boys have reached their objective and are digging in with intrenching tools furnished by Ordnance. Others are taking cover midway, lying at full length and pumping shot after shot kaiserward. Their service rifles are loaded with cartridges held in clips and carried in ammunition belts—all coming from Ordnance. A trench periscope furnished by Ordnance is stuck in the side of a shell crater, enabling its occupants, themselves unseen, to safely observe the movements of the enemy.

Covering the attack of the storming troops machine guns provided by Ordnance are searching out the vulnerable points in the enemy's line, firing bursts of nickel-jacketed bullets at the rate of 600 a minute. Each of these guns, light enough to be carried by one man, develops more power in action than does a racing automobile. Up come the ammunition boxes containing the belts of machine-gun cartridges needed to satisfy the appetite of these hungry demons. Guns and boxes, cartridges and belts are all a part of ordnance. One battery of machine guns is carrying on indirect fire. Panoramic sights, clinometers, transits, angle-of-sight instruments, alidades, squares, protractors and special rulers—products of Ordnance—lay these guns to their unseen targets. Back of the machine-gun operators are the carts and voiturettes, furnished by Ordnance, ready to receive the guns, tripods, water boxes and empty ammunition boxes and hurry them away to another location.

American Ordnance is not merely a Government department. It is not merely a branch of the Army. It is not merely an industry. It is the most gigantic combination of industries of all time welded into a whole with a single aim. Its purpose is to multiply the power of the fighter through the ultimate adaptations of the power of science. The thunder of the battlefield is the voice of Ordnance addressing the god of war. This and succeeding articles will describe the American Ordnance organization which connects our fighting forces with the fighting machine shops of America.

Miniature cannon mounted on wheels—the 37-mm. "machine-gun exterminators"—are wheeled into position where their 1-lb projectiles, resembling overgrown rifle cartridges, can outrange and destroy the enemy's machine-gun nests. These guns, their ammunition and their auxiliary equipment are from Ordnance.

A barrage is being thrown from our light field guns

of 75-mm. caliber to protect the advance of our storming troops. These guns, which have been hauled into position by tractors furnished by Ordnance, are each of them throwing 15 or 20 projectiles a minute, together forming a curtain of fire that advances at a predetermined rate. Tons of shell are required for this barrage, and every 15 pounds of these tons represents a single round. Each round fired from each gun requires either a shrapnel with its matrix of resin, its stopper, its base charge, its case, its head, washer, inner tube, diaphragm, driving band, locking pin and lead balls or a shell with its bursting charge, booster, adapter and fuse. Each round fired from each gun requires a cartridge case. Each cartridge case requires a primer, which is made up of body, disk, cup, valve and inclosing wad and which is wrapped in tinfoil. Each round of this shrapnel barrage fired from each gun requires its combination fuse, the various partial assemblies of which comprise 51 separate components. When a shot is fired at the Hun from a gun of 75-mm. caliber or upward, with each shot goes a complicated mechanism provided by Ordnance, embodying in itself the highest developments of science and the skill of the mechanic, the physicist and the chemist.

Back of these light field guns are the miscellaneous

MAJ.-GEN. C. C. WILLIAMS

Chief of Ordnance

Born in White County, Georgia, and the son of Capt. J. H. Williams of the Confederate Service, the present Chief of Ordnance, graduated from West Point in 1890, fourth in his class. Two years with the Fourth Artillery School at Fort Monroe gave General Williams a thorough training in the use of material, the making of which was later to come under his charge.

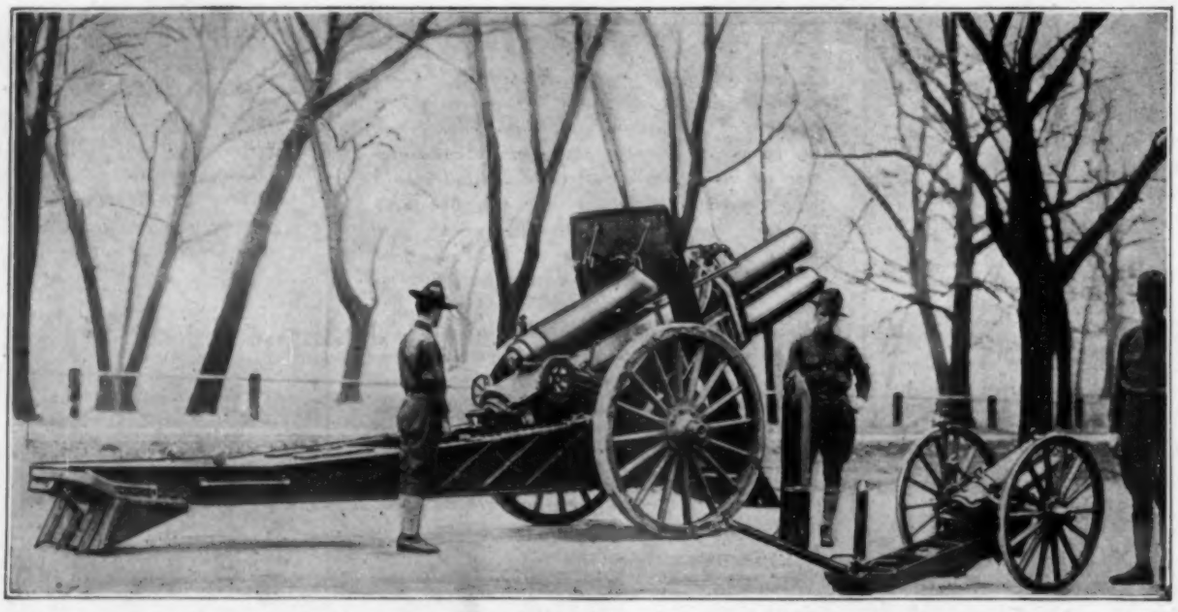
In May, 1918, he joined the Astor Battery, which was commanded by the present Chief of Staff, General March, and accompanied it to the Philippines. In September, 1898, he was made an aide on the staff of General MacArthur.

In the latter part of 1898 General Williams, then a captain, was transferred to the Ordnance Department. His experience during the next 16 years covered not only the methods of more prominent Government arsenals but also of large private concerns, such as the du Pont Powder Co. and the Bethlehem Steel Co., at each of which he spent two years as Government representative.

In November, 1914, he was sent to Germany as a military observer, where he remained five months visiting the German lines at various points.

In June, 1916, at the time of the Mexican trouble, he was detailed to the Southern Department as Chief Ordnance Officer, where his services were such that in May, 1917, he was appointed as Chief Ordnance Officer of the American Expeditionary Forces. General Williams accompanied General Pershing to France and was Chief Ordnance Officer abroad until 1918, when he was recalled to succeed Gen. C. B. Wheeler as Acting Chief of Ordnance. On July 16, 1918, he was appointed Chief of Ordnance.

General Williams is particularly fitted for his work, from his training as an artilleryman, followed by long experience with munition manufacture in both Government arsenals and private plants, and by his thorough insight into the methods of this war gained while Chief Ordnance Officer under Pershing.



The large gun in the illustration is an 8-in. howitzer wheeled mount. The small gun is the mountain howitzer wheeled mount. While neither the largest nor the smallest guns in use they represent rather forcefully the range of size needed in field artillery. Below the size of the smaller gun we have the 37-mm., or 1-pounder, rapid-fire gun, and the various machine guns. Above the size of the larger gun shown we have fixed howitzers mounted on platforms and railway mounts from 8-in. to 16-in. caliber

vehicles that aid and abet their action—tractors, ammunition wagons, caissons, limbers, supply trucks, etc. —264 of them to the artillery regiment. All of them are from Ordnance, as are the feed bags, horse covers, bridle sets, brushes, saddle trees, straps, harness sets, etc., that outfit such horses as are used in lieu of tractors. Out of the mist and smoke of battle the tanks come lumbering toward the enemy, veritable crawling forts, built and manned by Ordnance. Overhead are the sharp staccato of airplane-motor exhaust and the whir of propellers which tell that a squadron of fighting planes is starting for the enemy's lines. The machine guns that arm these battleships of the air, the mounts on which these guns are placed, the synchronizing mechanism that enables them to shoot through the propeller path without hitting a blade, the electric warmer that keeps the oil in the mechanism of the guns from freezing, the counting mechanism that tells how many shots are left in the belt, the special incendiary and armor-piercing bullets and the special disintegrating belts that hold the cartridges together and feed them into the gun—all of these are ordnance.

Steel helmets, hand grenades, service rifles and bayonets represent Ordnance in this picture. Without these weapons warfare would go back to the days of savage but ineffectual hand-to-hand struggle. Ordnance applies science to warfare thereby making a country's industries a most powerful factor of offense and defense and the deciding factor in a world war

At one portion of the line infantrymen are throwing rifle grenades, their service rifles placed butt to ground and inclined at 45 deg. Fitted to the muzzles of these rifles are the special grenade dischargers, minature mortars which hold the grenades so accurately that the rifle bullet which passes through the central hole in the grenade and which ignites its primer continues onward with hardly lessened velocity toward the enemy, followed by the grenade itself, the latter propelled by the otherwise wasted gas pressure back of the bullet. Close by, in another part of the trenches, a battery of 3-in. mortars is hurling somersaulting shells filled with deadly TNT, each shell fitted with a fuse that will detonate by impact no matter in what position the shell strikes its target. Flying overhead are the projectiles of the heavier trench mortars which are stationed further back, some of them as large as 240 mm. (nearly 9.5 in.), each of these monsters carrying with it 90 lb. of high-explosive destruction. Little and big, these mortars and their ammunition come from Ordnance.

Leaving the area of the light field guns and going back toward the base the eye encounters a perplexing variety of mechanism of offense and auxiliary equipment, which changes in nature with its distance from the front. Batteries of 155-mm.-caliber howitzers placed far back enough to outrange the enemy's light field guns are pouring their fire of destruction on the German ordnance. Some of these howitzers are mounted on wheels while others are on caterpillar treads and are drawn from place to place by detached tractors which await their need. Still others are mounted directly upon motorized tractors which climb in and out of seemingly impossible ditches, stop, fire their shot and again proceed. Portable machine shops, compressed into the space provided by motor-truck chassis, speed here and there to render first aid to damaged guns or tractors. Ammunition trucks, supply trucks, spare-parts trucks, observation trucks, motorized, and caissons and limbers of all sizes, some drawn by tractors and others horse drawn, are either parked in service on their batteries and regiments or are moving into position to serve them. Eight-inch howitzers on wheels are raising their ugly snouts toward heaven that they may send their selected targets to hell. "Nine-point-twos" and "nine-point-fives" of the Vickers type, mounted on platforms for firing and camouflaged under grass and leaves are roaring their contempt of Krupps. Wheeled limbers are standing by ready to move forward or backward when required. Fifteen- and twenty-ton tractors pull these heavy monsters about with ease over fields and ditches and, like them, come from Ordnance.

Overhead we hear the throb of an enemy's bombing plane which has somehow evaded our air patrols and is intent on "dropping an egg" on some of our valuable war mechanisms. Now our antiaircraft service comes into play. Complicated instruments, products of Ordnance, are sighted upon and follow the plane, determining its altitude, speed and direction and predicting its position at the moment of fire, taking into account the windage and the trajectory of the shell. Up goes a salvo of antiaircraft shell, each one fitted with a special fuse so delicate in action that contact with the thin fabric of an airplane wing is sufficient to explode it and yet so designed that accidental dropping upon the ground

in handling will not cause detonation. White puffs resembling tiny clouds come into being around the plane until a burst of flame and a falling meteor announce that ordnance and artillery have done their work.

Still further back, and beyond the range of the enemy's field guns, the voice of science is speaking through Ordnance in tones that make the earth tremble and that are felt fully as much as heard. Here are the monster railway mounts from 8-in. to 16-in. caliber uttering defiance of despotism and destroying the enemy's lines of communication far in the rear of his infantry. Each battery of these mobile monsters is accompanied by its quota of ammunition cars, spare-parts cars and railway machine shops, all furnished and designed by Ordnance.

Night comes, and with it come other manifestations of Ordnance. The big bombing planes start out to pay their compliments to the fortifications along the Rhine. Each is fitted with a release mechanism that holds fused and loaded bombs—a dozen or more of them—which will drop them one, two at a time, three at once or all together, according to the desires of the bomber. Mounted on the fuselage is the bomb sight, an instrument which takes account of the speed of the plane, of the altitude of flight and of the trajectory of the bomb and tells the bomber when to release his "egg" so that it may find its desired mark. Release mechanism, bomb sight and bombs, all of them are from Ordnance.

Signal lights and rockets pierce the darkness, displaying red, white or green signals or "caterpillar" combinations and occasionally painting the French tricolor against the black of night. Powerful illuminants suspended from parachutes and shot from bombs make no man's land as bright as day. Signal stars shot from signal pistols in the hands of men in no man's land tell of their position or of the movements of the enemy. Back from its successful mission comes the squadron of bombing planes, flares fastened to their wing tips lighting the landing field as they near the ground. All of these pyrotechnical displays, which make every night at the front resemble the 4th of July in America, are products of Ordnance, and must be planned, tested, procured, inspected and shipped by Ordnance.

Deprive warfare of what ordnance does and war becomes a contest of physical strength instead of the combat of science with science, industry with industry. How is American Ordnance living up to these responsibilities?

Tractors from 2½ to 20 tons are being built and shipped in enormous quantities. They will haul guns through places where it would seem impossible for guns to go. A shrapnel burst which would kill all of the horses in a battery will not materially damage one of these tractors. They will plow through mud, climb into and out of ditches, crawl over rocks or fields and accomplish seemingly impossible maneuvers

Two distinct American Ordnance bodies exist—one abroad and the other at home. The former is a part of the American Expeditionary Forces under General Pershing, and immediately under the chief Ordnance officer, Brig.-Gen. J. H. Rice. This body of Ordnance has charge of the upkeep of the matériel used by the fighting forces, including the operation of the enormous base shops and relining plants in France. It salvages such spent ordnance matériel as can be reclaimed, studies the functioning of ordnance matériel in the field and transmits its findings and suggestions to the Chief of Ordnance. As a very general definition of functions the American Ordnance forces abroad deal with the maintenance and function of finished matériel, whereas the American Ordnance body at home has to do with the design, procurement, production, inspection and shipping of ordnance.

This series of articles will be largely confined to a

description of the work of American Ordnance in the United States, for the activities in connection with mobilizing the mechanical resources of America are of especial interest to the readers of the *American Machinist* who have contributed so largely to the results obtained. But before describing the organization of Ordnance in America it will be well to get an idea of the size of the problem that Ordnance faces.

The hardest problem that the home organization of Ordnance has had to encounter is that of its own expansion. The factory manager who is faced with the problem of doubling his plant in 12 months has his hands full. Few previously existing individual war plants can show a 500 per cent. expansion, and those that can invariably know that they have done something worth talking about.

Before the war American Ordnance included a total of 97 officers, including Coast Artillery officers detailed to Ordnance. This 97 included the Chief, the arsenal heads and their assistants, the inspectors at private plants and in fact every ordnance officer in the American Army. Less than a month ago a cablegram from General Pershing requested the sending abroad of 1000 trained ordnance officers for the service of supply in France—one order from Pershing, calling for 10 times as many officers as the total in the department 18 months previous! Today there are close to 10,000 people in American Ordnance on this side of the water, *an increase in 19 months of over 9000 per cent.* Of these approximately 8000 are civilians. Of the 1300 commissioned officers, 97 per cent. are from civilian life.

Previous to the war the annual appropriation for ordnance averaged $14,000,000. Since the war the Ordnance Department has obligated over nine billion dollars, the monthly average showing an increase over the peace-time expenditure rate of *40,000 per cent.* Expressed in terms of equivalent cost, enough labor and material is going into American ordnance work to complete a Panama canal every 30 days.

In peace times American Ordnance activities had to do with 11 Government arsenals and a half dozen private plants. Today American Ordnance embraces over 5000 contractors, including all of the old arsenals and many new ones. During May and June of this year close to 2,000,000 sq.ft. of storage space was constructed for the Supply Division of Ordnance for the storage of component parts only. The total requirements of Government storage space for ordnance components in this country amount to 18,500,000 sq.ft., equivalent to a warehouse 50 ft. wide and 6 miles long. This is Government ordnance storage only for components only and in America only.

Previous to the war our chief source of supply of shell for mobile field artillery was Frankford Arsenal. In 1914 this arsenal produced an average of 340 shell a day, averaging 3 in. caliber. Today a year's program for mobile artillery calls for over 80,000,000 shell, or an average of 250,000 shell a day. Previous to the war the United States possessed a total of less than 500 mobile field guns of 3-in. caliber and larger. Today close to 20,000 additional field guns of 75-mm. and larger caliber are under contract.

At the outbreak of the European war it was impossible to buy a million pounds of smokeless powder in the United States without increasing the facilities

One round of shrapnel fired from this gun, which is of 75-mm. caliber, represents the work of from 25 to 50 separate manufacturing plants and machine shops. An immense amount of human energy has been put into organizing the flow of artillery ammunition components. The lack of the smallest component of this material holds up the whole program as far as the complete item is concerned. This gun is of no use without shells, fuses, propellants, etc. Ordnance is a typification of drudgery of detail

for its manufacture. That amount is about one-fourth of that which our fighters abroad require in a single day.

The Ordnance organization in America, whose duty it is to make these seemingly impossible requirements a matter of fact, is the connecting link between our industries and our fighters. Its form of organization is shown in the folded supplement. Headed by the Chief of Ordnance, Maj.-Gen. Clarence C. Williams, who is aided by nine special assistants, it resolves itself into three main operating divisions having strictly functional duties. These are the Engineering, Procurement and Inspection divisions. Six additional divisions perform duties which supplement the work of the operating divisions, or control it, or undertake certain special but necessary activities. They are the Administrative, Estimates and Requirements, Supply and Nitrate divisions, the Division of Ordnance Training and the Director of Arsenals. The functions of each of these divisions will be found outlined upon the organization chart and will be described in later articles. The Ordnance organization has changed in form and must continue to change to meet changing conditions and requirements. War work in industry is a continually advancing program. First comes the initial period in which most of the activities await engineering decisions; then for a time procurement is the main activity, and finally production comes into play, and with it inspection. It must be a flexible organization capable of mobilizing effort in force wherever needed.

*Besides the explosive hand grenades which these men are throwing, chemical and gas grenades are furnished for special purposes. These grenades make an infantry organization a sort of human artillery. The explosive grenade contains TNT and has a destruction radius of 25 yards**

The functional form of organization with its obvious disadvantages was a necessity in view of the fact that ordnance activities strained the limit of America's industrial resources. It was necessary to centralize engineering for example so that interrelated engineering

This pile of steel represents the first visible step that Ordnance takes, in which it gathers the raw material for its program. But before this visible step there are numerous invisible ones, in which a military program is defined, material designed and manufacturing capacity canvassed. All of these things are preliminary to the letting of contracts and involve an enormous amount of detail work in planning and executing†

activities could be properly controlled. The previous organization in which the Gun Division was separate from the Carriage Division pointed out this necessity in unmistakable fashion. It was necessary to centralize procurement in order that one division of Ordnance should not compete against another for limited resources of raw materials or production capacity. It was necessary to centralize inspection in order to avoid duplicating the inspection forces in the same plant, district or city.

When a body of able men are hurriedly got together to attack a problem of the magnitude of Ordnance it is inevitable that personal beliefs as to the best way to do things will assert themselves. For a time it was evident that those who believed that the system is everything and the individual nothing were in the ascendency, even though in the minority. It was soon found, however, that the functional division of duties, while according beautifully with the theory of omnipotent system, lacked the all-essential individual responsibility which is necessary for speedy results. It is hard to beat the "one-man control" if the one man is the right man. Of course the ordnance problem is entirely too vast for what is generally known as one-man control and responsibility, but the principle of centralization of authority has been adopted by the present Chief of Ordnance as a means of speeding up the efforts of the functional organization. To this end each of his nine special assistants is charged with full authority from start to finish, covering various important items of matériel or particular branches of activity.

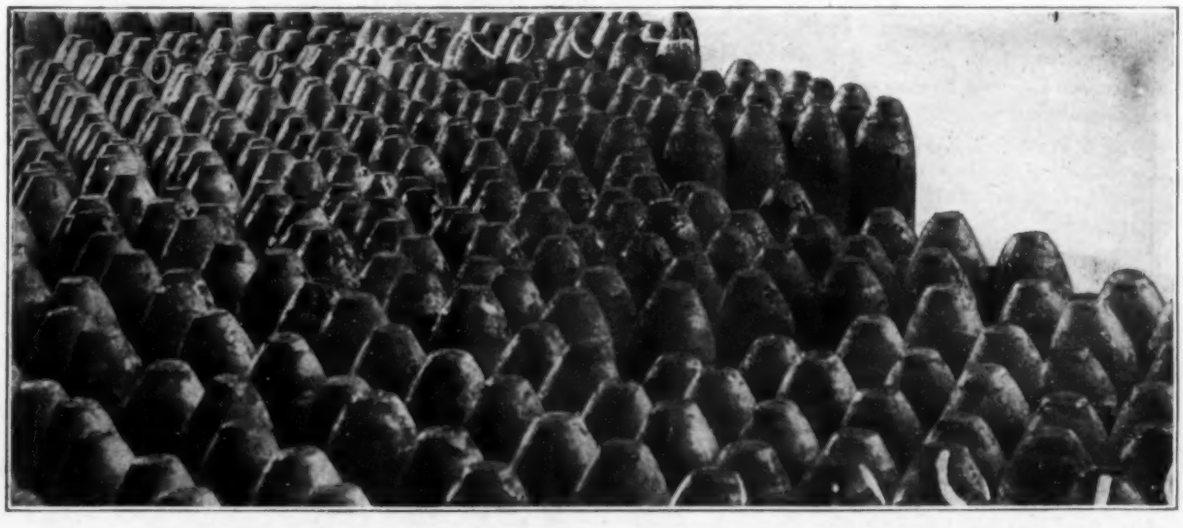
Brig.-Gen. Guy E. Tripp, for example, formerly chairman of the board of directors of the Westinghouse Electric and Manufacturing Co., is now in charge of the Ordnance district offices as special assistant to the chief. W. H. Marshall, formerly president of the American Locomotive Co., is assistant at large. Lieut.-Col. Ralph Crews, formerly of the legal firm of Adams, Crews, Bobb & Westcott, Chicago, is in charge of matters pertaining to the interpretation of contracts. W. W. Coleman, formerly president of the Bucyrus Co., is in charge of cannon, carriages and their accessories. Brig.-Gen. C. C. Jameison, who was formerly a business partner of Major-General Goethals, is in charge of artillery-ammunition metal components, excluding loading-plant operations. Lieut.-Col. W. C. Spruance, formerly director of explosives manufacturing of the du Pont Co., is in charge of chemicals, explosives, propellants and their loading. Lieut.-Col. Bascomb Little, formerly building contractor of Cleveland, Ohio, is in charge of equipment matériel, automatic arms, rifles, pistols and their ammunition and accessories. L. J. Horowitz, formerly president of the Thompson-Starrett Construction Co., is in charge of tanks, tractors, trailers and similar items.

Col. Earle McFarland of the regular establishment, who has done excellent work successively with machine guns and small arms and aircraft armament, is now special assistant in charge of drop bombs and trench-warfare material.

Through this staff of special assistants, embracing most needed items of ordnance, the personal follow up is provided from the inception of the project to the final delivery of the completed article. The functional divisions, which must of necessity be cumbersome in action in order to safeguard the daily expenditure of between 15 and 20 millions of dollars, are thus supplemented where most needed by the efforts of men who are accustomed to big responsibilities and whose job is to get results.

These then are some of the things that American Ordnance has to do. Succeeding articles will tell some of the accomplishments that have been made, how they are made and who are making them.

*Photographs copyright by Committee on Public Information.
†Photograph by Kadel & Herbert. Also Ordnance photograph for headpiece



The steel pile shown on the opposite page will later become this collection of partially finished shell forgings. Later on, after many men and many plants have put their labor on these chunks of metal, they will feed the guns that are aimed at Imperialism. Before this time comes, thousands of successive handlings of these shells will have occurred, not only during the many manufacturing operations but between and after them

Patriot or Hun?

By Berton Braley

Many a workingman thinks in this wise:
"What does it matter how little I do?
Why I'm just one in some millions of guys,
So if I feel like a layoff or two,
What is the diff'rence? We won't lose the war;
We'll lick the Kaiser, it's easy to see;
That's what we sent all our troops over for—
Why should you get in a sweat about me?"

Well, let's suppose every soldier in France
Thought of his job in that casual way;
Then when his officers bade him advance
He would consider the order and say:
"Oh I'm just one in some millions of men
And as I'm weary as weary can be,
Guess I won't go into battle again;
They can get on very well without me!"

Can you imagine how far we would get
Fighting the Kaiser with soldiers like that?
Yet in the army of labor you've met
Plenty of fellows with that line of chat—
Men who would fight you for calling them "Huns"
Yet who, by slacking, are earning the name,
Holding down food and equipment and guns—
Cursing the Kaiser, but playing his game.

Building Wooden Ships for the Emergency Fleet Corporation

By E. A. SUVERKROP
Associate Editor *American Machinist*

III. Planking and Interior Work

With the completion of the framing, the planking on the exterior and ceiling on the interior of the ship can be fitted and secured. With the planking in place and the seams caulked the ship is ready for launching.

AT THE bow and stern the planks of the planking are not only tapered but their edges are beveled. The exact shapes of these planks are ascertained by the use of thin boards, called "battens," ¼ in. thick and of suitable width and length. These are tacked onto the frames in the positions the planks will later occupy. They are then marked off to the correct width at each frame, the edges are dressed with a plane to lines connecting these marks and the batten is used as a templet to mark off the plank. Each of the planks is beveled on the edges, otherwise they would not fit each other properly throughout their thickness. The angle of this bevel with relation to the frame is ascertained with a bevel square, and as it varies at each frame it is marked on the batten. Formerly all this work of dressing the planking was done with the broad axe, adze and plane. A machine has been devised to handle this work rapidly and accurately. A general view of it appears in Fig. 18 and a more detailed view of the mechanism from the opposite direction is shown in Fig. 19. In both these illustrations similar reference letters will refer to similar parts.

The carriage *A*, made of timber with cast-iron braces, runs on wheels carried by the timbers *B*. On top of *A* are two guide bars *C*, the object of which will be explained later. At *D* are a number of screw-operated clamps, or vises, and below them and running the entire length of the carriage is a shelf *E* which forms the stationary jaw of the vise. The timber to be beveled is held between this shelf *E* and the clamps *D*. The carriage is traversed by means of a rope passing around a drum at the far end of the machine. Means are provided to accelerate the speed of the carriage on the return, or noncutting, stroke. The rope can be seen at *F*, Fig. 19, and the rollers on which the carriages travel at *G*. At *H*, Fig. 19, is a machine knife head similar to those used in wood-planing machines. This is mounted on bearings in a bracket which can be tilted at an angle in the quadrant *I*. The bracket can also be traversed across the rail *J*, which performs the same function as the cross-rail of a metal planer. The tilting mechanism of the knife head and the cross-movement of the knife head on the rail *J* are controlled by handwheels. Two men operate the machine, one handling the beveling control and the other the cross-movement. The lengthwise traverse is controlled by a shifter.

The operator controlling the bevel reads his directions from the marks made on the timber by the man who marked it off. The one who controls the crosswise and lengthwise traverse watches the scribed mark on the timber and operates the cross-slide so that the cutter will cut to the line. In cases where there is a great deal of stock to be removed it may be necessary to take several cuts before the line is reached. The guide bars *C* are formers performing the same function as those used in profiling or form milling. They can be set to any desired curvature, and a follower roller on the end of the spindle will cause the cutter head to follow. The chips, which when taking a heavy cut are almost the size of small kindling wood, are thrown into the hood *L* and from there drawn by the exhaust system and deposited in the dump. The cutting speed of this machine is about 100 ft. per minute.

The planks of a ship are fitted tightly together on the inside next to the frames, but on the outside they are

beveled so as to leave a seam, or opening, for the reception of the caulking material. These caulking materials are cotton and oakum. A thread of cotton batting is driven in with a caulking iron *D*, Fig. 10, first, and then on top of it a thread of oakum, after which the outside of the seam is pitched either with ordinary pitch or with marine glue, an improved product that does not under varying temperatures become either too brittle or too soft, but always sticks to the planking in the seams. The planking on the ships under discussion is from 5 to 6 in. thick and the seam for the oakum is about 2 in. deep. The old method of caulking wooden ships, and practiced to a great extent at this yard, is as follows:

The seam is first wedged open ahead of the caulker for some distance by driving in a number of wedge-like caulking irons *D*, or reaming irons *E*, Fig. 10. The caulker follows up first with the thread of cotton batting and then with the oakum, driving them in tight with his caulking tool and a heavy, live-oak mallet *G*, Fig. 10. The cotton and oakum are not laid in the seam in a continuous thread but are folded back and forth in a manner that must be seen to be grasped and which is called "tucking." As the caulker advances, the wedges are removed one at a time and driven into the seam ahead of the other wedges which are spaced about 8 in. apart, close enough together so that the seam will be opened properly.

Another Method of Caulking

Another method of laying the cotton and oakum in use in the yard is by means of a device attached to an air hammer. The prepared cotton is carried on a sort of spool and the air hammer draws it off the spool and drives it into the seam. The same tool is also used with oakum. An air-operated device designed by Mr. Traylor is also used for opening up the seam. This is shown in Fig. 20. This tool bulges slightly in the center at the section *AA*. The operation of the tool is as follows. This tool, called a caulking reamer, is inserted in the head of the air hammer and driven by it straight into the seam. The operator then brings the handle of the air hammer near to the planking; the cylinder of the air hammer is then parallel to the face of the planking and in line with the seam. The hammer is started and the tool driven along the seam. As the tool is thinner at the surface of the planking than it is at *A*, about 1 in. below the surface and within the seam, a recess is formed between the two planks into which the oakum and the cotton can readily be driven and where they are compelled to stay as the seam is narrower at the outside.

The planking on the inside of the ship is called "ceiling," shown in Fig. 21. In these ships it is fastened with heavy iron bolts riveted at both ends. The method is to drive the bolts through holes about $\frac{1}{16}$ in. smaller in diameter than the bolts used. A malleable-iron washer is placed over the end of the bolt, which is then riveted over so that the washer forms a sort of head. These washers are termed "clinch rings."

Inside the ship and on top of the keel heavy timbers are placed and bolted to the keel by heavy iron bolts passing entirely through them and the keel; these timbers form the keelson. The total depth of the keelson is 28 in. and its width 70 in. The keelson reaches from stem to stern and greatly stiffens the structure. In the engine space in the center of the ship the keelson is carried out on both sides so as to form a seat for the bed of the engine. The timbers that form it at this point are through-bolted from side to side and also up and down clear through the planking on the outside of the ship. The holding-down bolts for the engine pass entirely through this structure of timber and have large washers sunk into the planking on the outside. The bolts at the outside are riveted over the washers. The cast-iron engine bed thus rests on a solid timber foundation 68 in. thick.

There are two bulkheads dividing the ship into three main parts. They run entirely across the ship and from the bottom clear up to the deck level. On these ships they are 10 in. thick, and great care is exercised to make them as watertight as possible. They are edge-bolted; that is to say diagonal holes are bored which pass through series of three of the timbers that go to make the bulkhead; iron bolts are then driven with the air hammer into these holes. As these holes and bolts are started at each seam in the bulkhead the entire fabric of the bulkhead is securely bolted together.

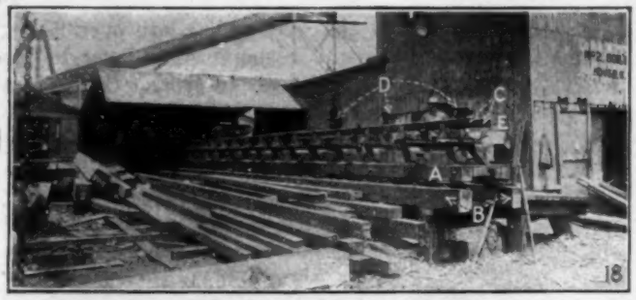
In Fig. 22 is shown a gang of men edge-bolting one of the bulkheads. Two men *A* with an air drill are boring the diagonal holes that pass through sets of three of the timbers that form the bulkhead. Thus the row of holes being drilled will pass through rows *E*, *F* and *H*. They are followed by a gang of three men who insert and drive the bolts with an air hammer as shown at *B*. When completely driven the bolt heads come just below the surface of the timber. Where the timbers for the bulkheads are not long enough they are scarfed as previously described. One of these scarfs can be seen at *C*.

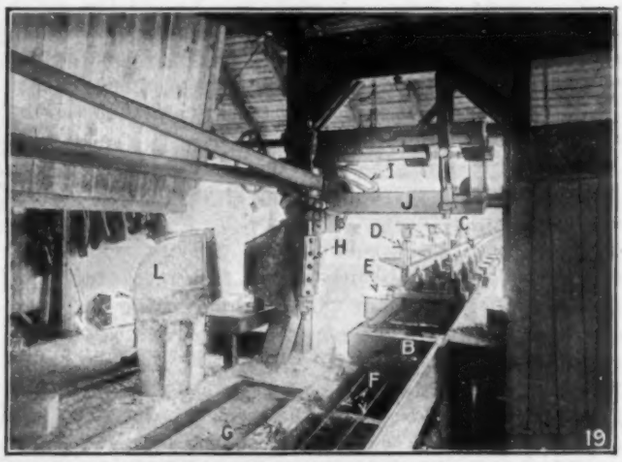
At the very bottom of the ship one plank of the ceiling is removable so that the bilge can be inspected. It is here at the lowest part of the ship that the bilge water collects and is pumped by the bilge pumps overboard. There is always a chance of the drainage system of the bilges becoming choked through foreign matter such as chips, waste, etc., getting into the openings through which it is intended that it shall flow. This is the reason for having the bilges accessible.

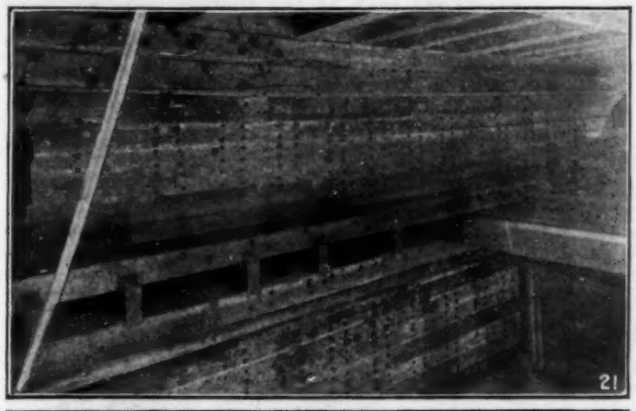
Limber-Chain Hole

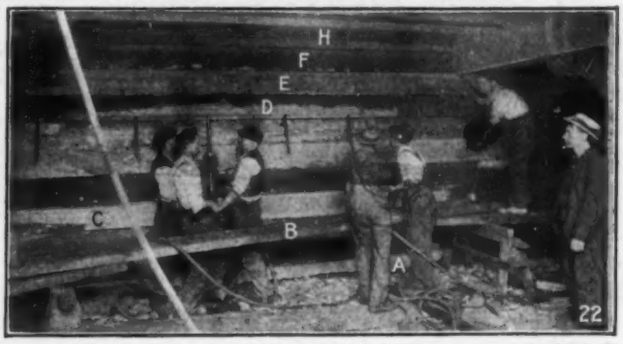
Some distance on each side of the keel a hole, or groove, is formed, half in the frames and half in the planking. This hole runs practically the whole length of the ship and laid in it is a chain called a "limber chain," the hole in which it is laid being termed the limber chain hole, which can be seen in Fig. 2. The object of the hole is to act as a drain and the chain is intended to clear it should it become choked. This is done by pulling the chain backward and forward through the hole.

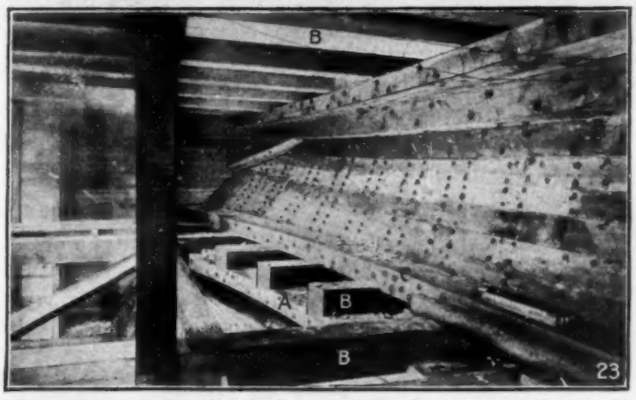
The seams of the bilge ceiling are caulked and pitched or they are made absolutely tight by driving pine wedges edge to edge throughout the entire length of each seam. The seams are opened up for the reception of the wedges by means of a "reaming iron," shown in Fig 10 at *E*. It is merely a steel wedge shaped very much like a common hatchet but having a steel handle which loosely surrounds what in a hatchet would be where the eye is. One man holds the reaming iron while another drives it into the seam with a heavy wooden

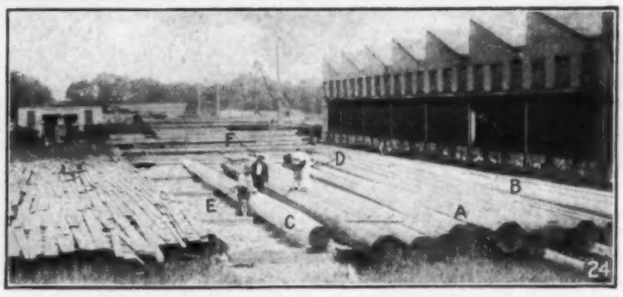


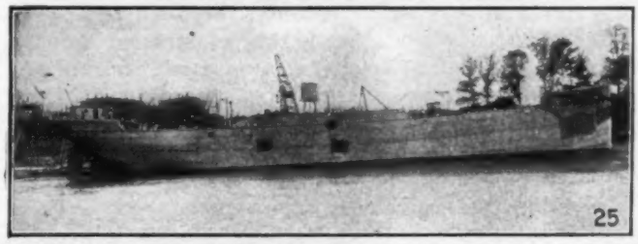


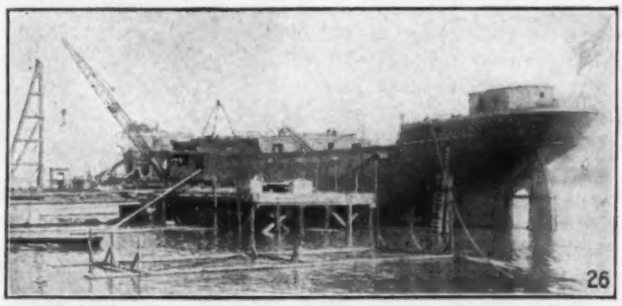


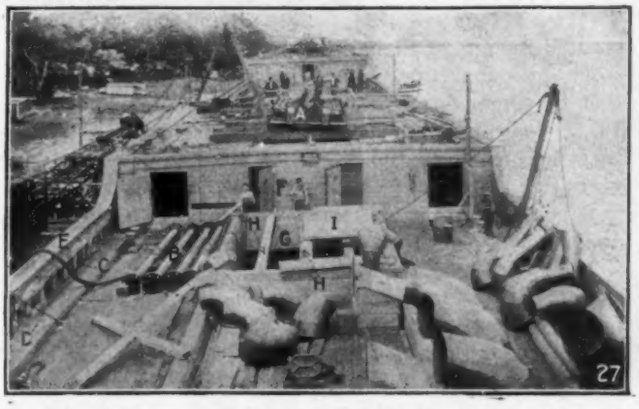


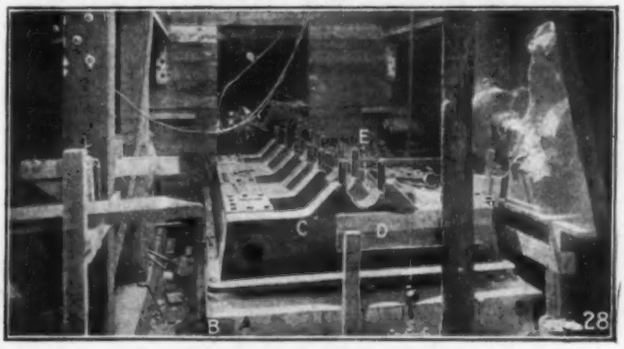












FIGS. 18, 19 AND 21 TO 28. VIEWS OF VARIOUS OPERATIONS

Fig. 18—General view of the beveling machine. Fig. 19—The cutter head of the beveling machine. Fig. 21—Showing numerous bolts in the ceiling. Fig. 22—A gang edge-bolting a bulkhead. Fig. 23—Heavy stringers in the after-hold. Fig. 24—The spar yard. Fig. 25—Side view of the "Alvada." Fig. 26—View of the "Alvada" from the port quarter. Fig. 27—The deck of the "Alvada." Fig. 28—The engine room looking aft

mallet called a beetle, one being shown in Fig. 10 at *F*. Where the sides and bottom of the ship meet is the weakest part. In order to strengthen it eight rows of 14-in. planks are put in here in the same manner as the thinner floor ceiling.

Near the bow and the stern down in the hold on both sides of the ship there are heavy strengthening stringers made up of heavy timbers bent to the curvature of the ceiling of the hold. These timbers are, like all the others, heavily bolted to the frames of the ship. In Fig. 23 at *A* one of these strengthening stringers can be seen. At *B* are the hold beams, which correspond to rafters, or joists, in a house. The so-called waterway *C* is merely a stringer or strengthening beam, and runs the entire length of the ship. I have knocked around ships for 45 years; have been through every part of a number of the old teak-built East Indiamen that were once supposed to be the heaviest built ships afloat, but they are fragile and light compared with the ships built to the specifications of the Emergency Fleet Corporation. If one of them ever rams a U-boat it will be all over except the air bubbles and the patches of oil.

The seams after caulking are painted with a narrow brush having a single row of bristles, after which they are filled with a mixture of lampblack and cement or white lead and tallow, and then the entire ship is painted.

Lining the Shaft Hole

After the shaft hole is bored it is lined with a tube called the stern tube. The tail shaft is put in and the propeller is slipped onto the tapered end of the tail shaft; the nut is screwed on and set up tight and the taper pin driven through the shaft behind the nut or through both nut and shaft. The stern gland is packed and the sea connections for the engine are made and inspected for tightness. The ship is now ready for launching. The final preparation for launching consists in placing greased timbers in the shape of a runway under the ship. These timbers reach from well forward on the ship's bottom clear to the water. On top of these other greased timbers are placed, forming a sort of cradle for the ship to rest upon. Wedges are driven in between these upper greased timbers and the ship so that they take her entire weight. The keel blocks on which she was built are then removed. At this time she is held from sliding into the water by two timbers at the bow and a sort of wooden key at the stern. When the time comes for launching, the key is knocked out and the two timbers sawed through and, held upright by her cradle, the ship and it slide down the ways into the water.

After launching she goes to the fitting-out slip where her engines and boilers are placed on board and the remainder of the woodwork on deck and below is finished. When it comes time to step her cargo masts they are put in with the aid of a steam crane, or failing this with a pair of shear legs. The cargo masts pass through a hole in the deck and their lower ends fit into a "step," or recess, either on the keelson or, in the case of the after mast of the ships under discussion, on top of the shaft alley.

In Fig. 24 is shown a view of the spar yard. At *A* are the rough-trimmed spars of Oregon pine as they come from the forests of the Northwest. These "sticks," as they are termed by the spar maker, are over 90 ft. long and roughly octagonal in shape. The layer to the left is under a covering of boards to protect them from the weather. To digress for a moment this item of protecting timber is a matter of great importance in the shipyard. Each variety of timber has its own idiosyncrasies. Black oak must be kept submerged in water or wet mud; the same treatment would ruin some of the other woods. Yellow pine can be kept out in the open, but black oak under the same conditions would rot in no time. Thus each of the timbers requires some special treatment known to the naval architects familiar

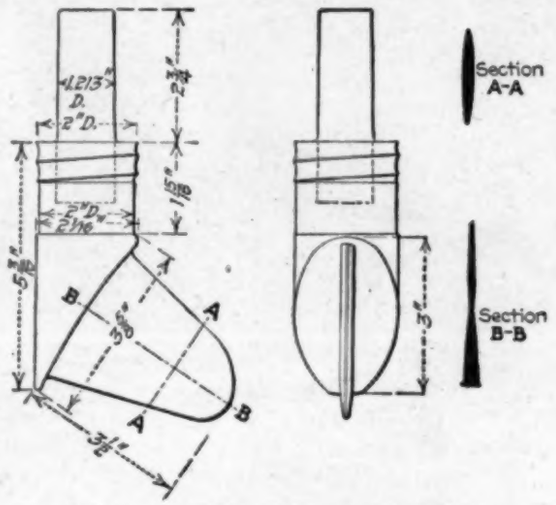


FIG. 20. AIR-OPERATED REAMING TOOL

with wooden-ship construction and to the skilled wooden shipbuilders, who see that the wood that goes into these ships is properly taken care of.

Formerly there was a sort of superstition that a ship could not be built out of green lumber and that ship lumber had all to be seasoned for at least two years. This superstition was exploded some time ago. The "Carnegie," a wooden brigantine constructed for the Carnege Foundation for magnetic research, was built of green lumber, some of which was growing on Long Island two weeks before it was put into her. I see by the papers that she has just completed a long cruise and is no worse for having been built of unseasoned stock.

Seasoning of course does improve some woods. There are at the Brooklyn Navy Yard some balks of live oak that were found buried under ground when they excavated for one of their dry docks some years ago. The story goes that they looked up the records and found that these pieces of timber 3 or 4 ft. square and 30 or 40 ft. long had been buried underground (to season them according to the vogue of that day) nearly 100 years ago. This may or may not be the case, but I tried to cut a sliver off one of them with my knife and it was as hard as bone. But to return to spar making.

The broad axe, the adze and the plane, with a large pair of calipers for gaging, form the principal tools used by the spar maker. The spar at *B*, Fig. 24, has been completed and painted lead color, while the one at C is just getting the finishing touches with the hand plane in the hands of the workman marked *E*. The man at *F* is calipering the spar, but the calipers, though large, are too small to show in the illustration. The man at

D is "dubbing off" another mast with the adze. Three men can under favorable conditions finish one of these 90-ft. masts in about 11 days I am told.

Mr. Traylor has built a large lathe (which is now being erected at the yard) for this work. There are some novel features about the machine, but its production can at present only be guessed at. I have heard a number of these guesses, which range from "a spar in about two days" to "it can't be done on a lathe." I do not suppose I need mention that the latter guess was made by a spar maker, but having seen some of the devices originated by the Traylor Engineering Co. my belief is that the former guess will come pretty near being correct.

Figs. 25 and 26 show the "Alvada," the first ship launched at the Traylor yard, lying at the end of the fitting-out pier ready to receive her engines, boilers and other equipment and to have her exterior and interior woodwork finished.

Fitting-Out Pier

The fitting-out pier has tracks connecting with the main line of the Pennsylvania Railroad between Philadelphia and New York. A large traveling crane with a boom of sufficient length operates on these tracks and handles the heavy parts of the machinery and other fittings, such as the engine bed shown in Fig. 27, at *A*, where it is deposited on heavy timbers over the engine-room hatch preparatory to lowering it to position in the engine room. At *B* are shown four lengths of "tunnel" shafting; that is to say the shaft that connects the "thrust" shaft with the tail shaft. The thrust shaft is the short length of shaft which connects directly to the crankshaft of the engine and transmits the push of the propeller to the ship.

This illustration is from a photograph taken from the top of the wheelhouse aft. An idea of the enormous bulk of these ships can be had from a comparison of the size of the man at *F* with the bulwarks, or railing, at the side of the ship. The timber heads at *C* are the ends of one-half of the frames, as previously mentioned. The built-up stringer *D* is called the waterway, and acts as a supporting brace for the timber heads, on top of which is the rail *E*. Formerly in wooden-ship construction the timber heads were braced by knees alone at every alternate one or perhaps even less frequently. At *G* is shown one of the after-hatches with its wooden hatch stringers *H* and wooden hatch covers *I*. The stringers *H* are removable so that the hatch can be made entirely open for receiving or discharging cargo.

In Fig. 28 is shown a view looking aft from the boiler room. At *A* is the timber foundation built up and cross-bolted in both directions. As previously stated this is over 6 ft. thick. At each side are heavy cast-iron sills *B* through which the cross-bolts in the top tier of timbers pass. At the time when the illustration was taken they were lining up the engine bed *C*. The wire method of lining up is being used. The board *D* supports one end of the wire *E*, while the other end is carried aft to a point in line with the center of the tail shaft. The various tunnel bearings and the engine bed are then wedged into place so that they will be in line with the wire. With a known size of wire, known tension on the wire and known length between the supports of the wire the amount to allow for sag can be obtained from a table given in the "American Machinist Handbook." This table was compiled from accurate measurements made at the Newport News Shipyard several years ago.

Another method of lining up marine engines and shafts is by means of slotted boards. These give an absolutely straight line, but are a little more cumbersome to use than the wire. Their use is as follows:

The location of the center on the forward end of the tail shaft and the position that the center of the forward end of the engine shaft should occupy can both be readily ascertained. With these two points known, three boards are prepared. They are all three similar, but of course vary in outside dimensions according to the job and the temporary fixtures to which they are to be fastened.

The boards are each provided with a slot which when they are set up is horizontal. These slots are about $\frac{1}{32}$ in. wide. One board is set up beyond the forward end of the engine base with the slot horizontal and at the center height of the shaft. The other is set up in the same manner in line with the center of the tail shaft and between it and the last tunnel-shaft bearing. The third slotted board is used in the following manner to ascertain the center height of the various bearings: A candle or other light is placed beyond the slotted board at the tail-shaft end of the tunnel. The third slotted board is secured to the last tunnel bearing with the slot horizontal and gradually moved vertically. In the meantime a man is sighting through the slot in the forward board. With the introduction of the third board between the first and second boards the light becomes obscured to the observer, but as soon as the third board is brought up far enough so that the slot in it is in line with the slots in the other two boards the light at once becomes visible to the observer.

The same procedure is gone through for the other bearings. Alignment in the other direction is obtained either by a wire or by using vertically disposed slots. Boards with small holes in them have been tried, but it is a very tedious job to try to get them in line.

The "Alvada" is provided with the usual auxiliary machinery, but owing to the lack of space below it was impossible to take any photographs of it.

Exports and Imports for September

For the sixth time this year the value of the imports of merchandise for the current month has exceeded those for the corresponding month of any previous year, and for the fourth time this year the value of the exports for the current month has exceeded those of the corresponding month of any previous year. Imports for September were $262,000,000, an increase of nearly $26,000,000 over September, 1917, but a decrease of $10,000,000 from August this year. For the nine months ending September, 1918, the imports were $2,322,000,000, an increase of $40,000,000 over the corresponding period of 1917. Exports for September amounted to $550,000,000, an increase of nearly $100,000,000 over September, 1917, and $20,000,000 over August, 1918. Exports for the nine months were $4,561,000,000, a slight decrease as compared with last year, but an increase of $610,000,000 over the corresponding period of two years ago.

FOR SMALL SHOPS *and* ALL SHOPS

By J. A. Lucas

THREE HANDY DEVICES FOR SHOP USE

Manufacturing Drop-Forged Pliers

BY ELLSWORTH SHELDON, Associate Editor *American Machinist*

The plier, in one or more of its multitudinous forms, is familiar to everybody. Its uses are so varied and comprehensive that it is an indispensable adjunct to every workman's kit in whatever line he may be engaged, and one or more of them may be considered a necessary part of the equipment of every well-ordered household. This article describes the operations involved in its manufacture, some of which may be found applicable to other lines.

THE illustrations shown in this article were taken in the shops of Kraeuter & Co., Newark, N. J., whose line comprises pliers for practically every purpose, from the delicate implement used by the milliner to the sturdy tool that enables our boys in France to cut their way through the manganese-steel wire entanglements that constitute a portion of the barrier between them and Berlin.

In Fig. 1 may be seen a number of samples of the product; *a* being two styles of compound-lever cutting pliers that have been and are still being used to cut the German wire entanglements; in fact, until recently some form of compound-lever cutter has been the only tool capable of negotiating this material. A new plier which was designed for this service has been accepted by the Government and is now being delivered in large quantities. The new plier shown at *b* is lighter, less expensive to produce, lends itself more readily to other purposes, and is much less cumbersome to use, as it can be readily manipulated with one hand, whereas the compound tool requires the use of two. At *c* is the plier regularly used by linemen and electricians generally. While this is a sturdy and efficient tool, cutting with ease the ordinary sizes of wire used for electrical transmission, an exceptionally powerful hand grip is necessary to make more than a slight impression upon the German wire of manganese steel, which though fairly pliable and of only about 14 to 12 gage offers a surprising resistance to the cutting tool.

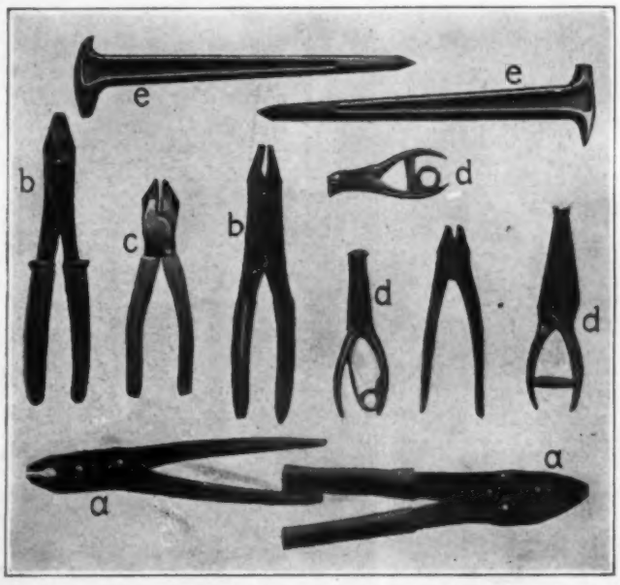


FIG. 1. A FEW VARIETIES OF THE SHOP'S PRODUCT

At *d* is shown several forms of the well-known ticket punch in everyday use by railroad men and others whose duty includes the punching of tickets. These punches range in size from the small tool cutting a single character to larger sizes cutting several letters and even words at once.

Most of the pliers made by this company are of mild steel, and the starting point for them is the drop-forge shop, one unit of which is shown in Fig. 2.

This forge shop contains a long double row of steam and drop hammers ranging in weight from 500 to 2000 lb. The unit chosen for illustration is a steam hammer with its forge and trimming press, which was for the moment out of service for the purpose of replacing a worn set of dies.

One of the oil-fired furnaces used is shown at *A* with the bars of steel in the fire ready to resume operations the instant the hammer die is reset. The upper die is in its place in the hammer head, while the lower die designated by the letter *B* has just been shoved onto the anvil from the rear of the machine and is resting temporarily upon two small bars before being lowered into place. Few drop-forgings are finished in one die impression, as unless they are small and the section conforms closely to the shape of the bar from which they are forged the die would be very quickly worn out of shape and after making a few pieces would fail to produce satisfactory work. For the reason that the bar must be gradually brought to shape by flowing a surplus of metal to the thick parts and pinching it away from thinner sections drop dies are usually made with one, two or more "breakdowns" in addition to a forming and a finishing impression.

At the time these photographs were taken no finished plier dies were available, but Fig. 3 shows a die that is used for forging a part of the regular product that will be described later in this article and which will serve the purpose of illustration.

In this die the white-hot bar of metal is struck five blows, four of them in swift succession and the fifth after the piece has been cut from the bar and passed through the trimming press shown at *C*, Fig. 2.

These stages are *a*, *b*, *c*, *d* and *e*, Fig. 3, the flat bar being first held edgewise in the breakdown *a* and a blow struck which narrows the bar for a portion of its length. It is then placed in the same position in *b*, which narrows the stock still more, and of course causes the displaced metal to flow outward, extending

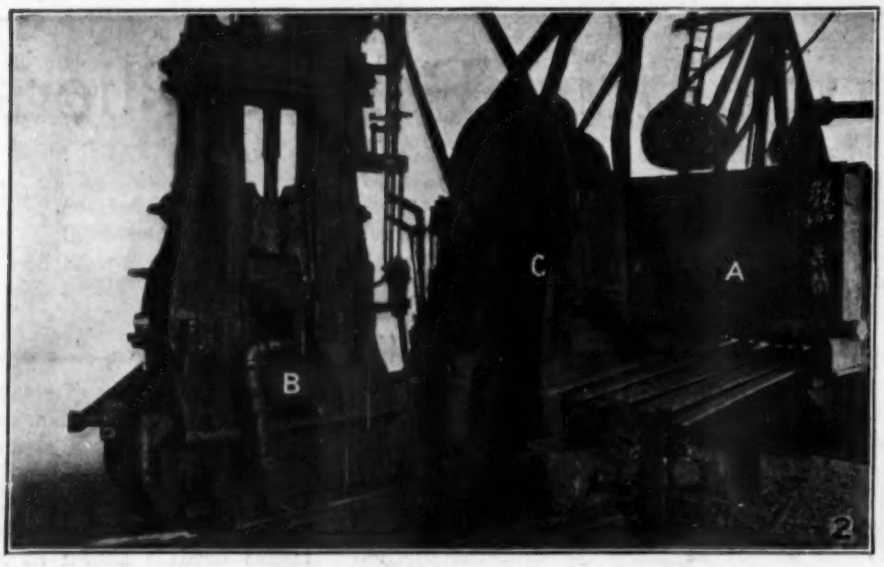


FIG. 2. A FORGING UNIT—STEAM HAMMER, TRIMMING PRESS AND FURNACE

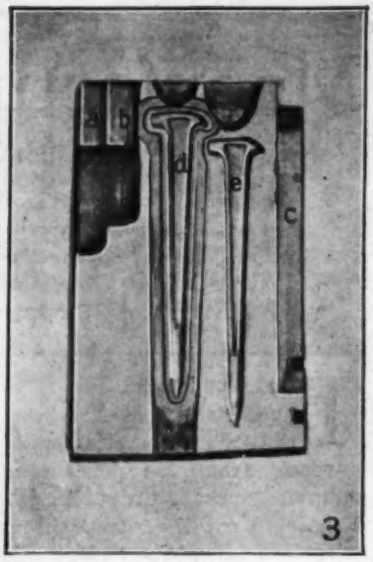
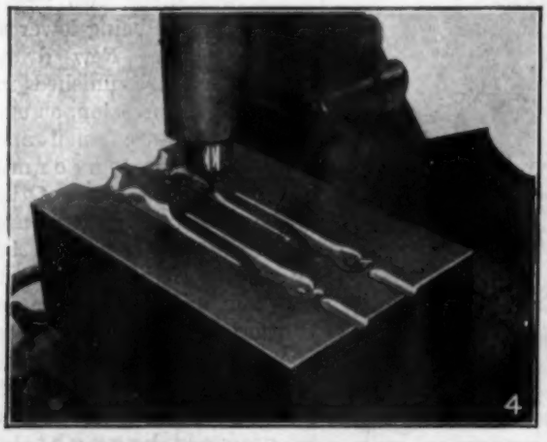
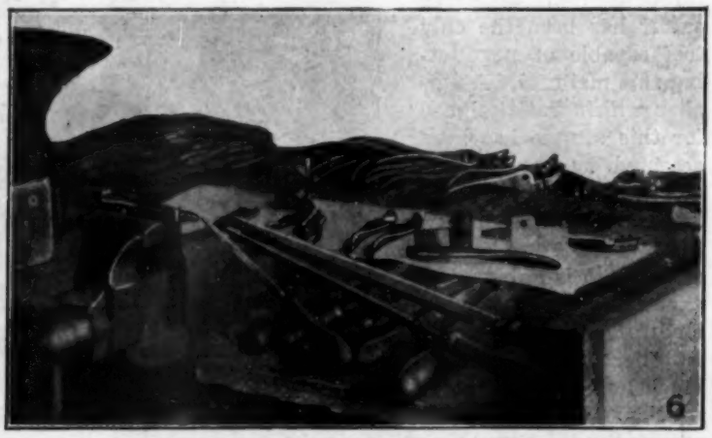


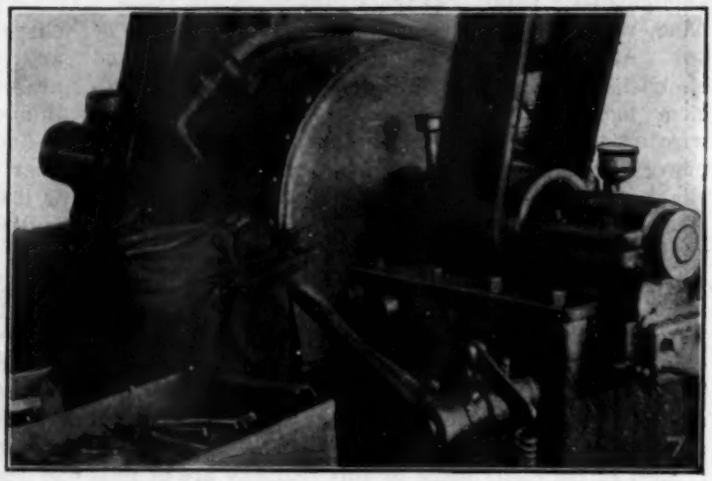
FIG. 3. ONE OF THE DIES

the length of the narrow portion. For the third blow the bar is quickly transferred to the breakdown *c* on the other side of the die which brings it to a rough approximation of the finished piece. It is then placed in the forming impression *d*, where it is struck one, two or more blows as may be necessary to cause the plastic metal to fill the die.

As it would be impossible to so calculate and distribute the material as to exactly fill the forming impression it is necessary to provide a surplus, and also to make provision in the die to take care of this surplus. For this purpose the surface of the metal of the die immediately surrounding the impression is milled away to a depth of from 0.010 to 0.020 in., as







FIGS. 4 TO 7. SOME OF THE DIES AND METHODS OF MACHINING

Fig. 4—Milling the impression. Fig. 5—Knurling die for plier handle. Fig. 6—Tools used in fitting plier parts. Fig. 7—Grinding outside of the joints

may be seen in the cut, allowing a thin film of metal to flow outward in all directions.

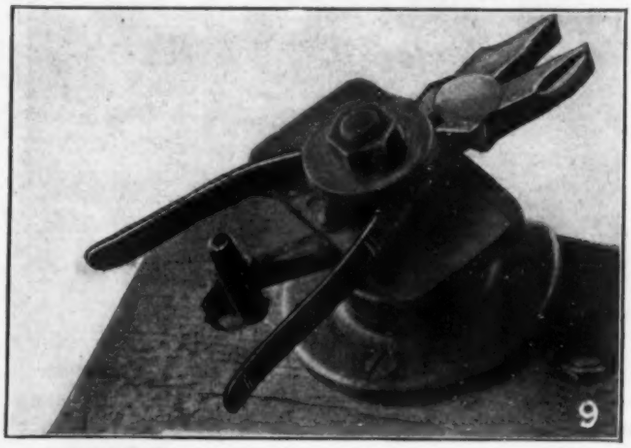
This film is known technically as the "flash," and must be trimmed off before the piece is finally struck in the finishing impression *e*. Thus it will be seen that before a piece is allowed to enter the finishing impression at all it has been brought so nearly to shape that this last impression has very little to do, therefore it will hold its shape for a comparatively long time.

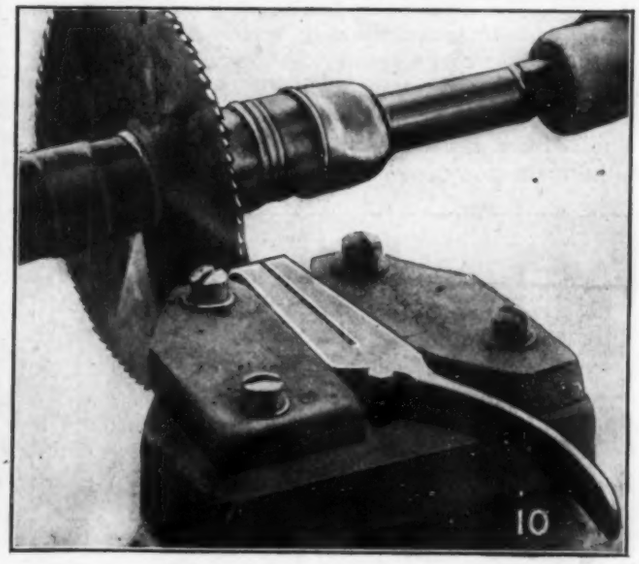
The foregoing description applies as well to dies used in forming the pliers, except that in many cases two plier parts are produced in each forging, being separated by the trimming dies at the time the flash is trimmed off.

A die for this kind of work is shown in process of construction in Fig. 4. Only the roughing and finishing impressions appear in the cut. These impressions must be finished very accurately, and the breakdown portion, the shape of which is less important, is left until the more exact parts are finished.

Fig. 5 shows the making of a die for the purpose of striking the knurling on a plier handle which is usually done in a second operation in order that the knurling may be sharp and clearly defined when the plier is finished. This die is worked out with milling cutters and hand tools to approximately the shape of the plier handle and is finished by placing the "hub" shown at *A* in the impression and striking it with a drop hammer while the die is red hot. This operation is sometimes performed upon the cold die by successive squeezes in a hydraulic press, the high spots being taken off with scrapers and engraving tools after each squeeze.

After the forgings have been tumbled and ground to remove burs and rough places they go to the machine room, where the joints are fitted up by milling, filing and drilling, and the jaw faces are "checked" in various patterns by special milling operations.





FIGS. 8 TO 10. OTHER MANUFACTURING OPERATIONS

Fig. 8—Edging a wire-cutting plier. Fig. 9—Device for holding large cutting pliers for edging. Fig. 10—Sawing the slot in a ticket punch

The filing is done to hardened-steel filing jigs, a few of which may be seen on the bench in Fig. 6. After this filing is done each pair of pliers is individually fitted up by expert workmen, the joint being carefully swaged and filed until each tool is brought into perfect working condition. The joint is then smoothed off on both sides by the double-disk grinding machine shown in Fig. 7.

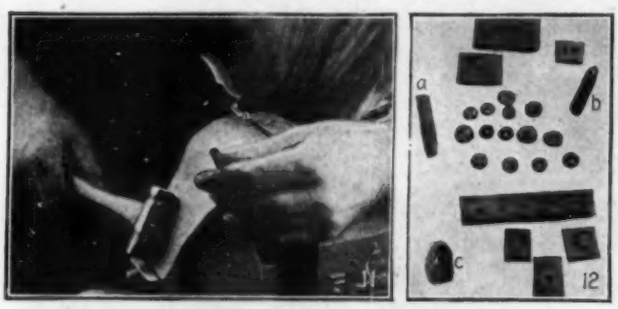
After this operation the tools are given their first polishing operation and are then ready for the carburizing and hardening process to which all these tools are subjected whether for cutting pliers or not.

Before hardening, however, all cutting pliers go to

the edging department, where each pair has its cutting edges brought into shape. This is done by hand, the pliers being held in an ordinary bench vise by means of special jaws or in some cases by special vises or clamps as shown in Figs. 8 and 9.

On some of the lighter classes of this work women are being employed with satisfactory results.

Another form of tool made by this company in large quantities is the ticket punch, which unlike the rest



FIGS. 11 AND 12. PUNCH AND DIE WORK
Fig. 11—Cutting a punch. Fig. 12—Ticket-punch dies

of this line of goods is made from steel castings instead of forgings, the reason for this being that the large or stationary jaw which carries the die is cored out to receive the movable or punch jaw, and this coring can be done to advantage only by the casting process.

After being rough-ground the stationary jaw has a slot sawed into it as shown in Fig. 10, and it then goes to a vertical milling machine, where the recess is milled for holding the die. In this work, where rapid production depends to a considerable degree upon

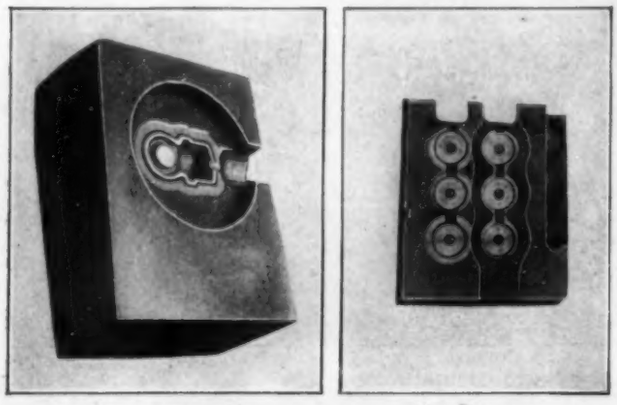


FIG. 13. DROP DIES FOR OTHER PURPOSES

skill of hand and eye, women are also successfully employed.

The movable member is then fitted into the tool and it is ready to receive the die.

As each ticket punch is practically an individual job in respect to the design it punches, each customer desiring some special shape to conform to his own ideas and duplicates being seldom required, the making of the dies is handled in a unique manner.

This work is practically all done by one man and an assistant who after long years of experience in this work are able to produce an original punch and die in an astonishingly short time.

In making up a new design a master punch is first filed on the end of a piece of drill rod, much as one would file up a steel letter or figure. It is then hardened, set into a foot press and sunk as far as possible into a piece of 14-gage soft sheet steel, the sheet resting on a smooth anvil block. This operation of course raises a lump on the under side of the sheet, which the operator removes by a swift pass over an emery wheel which is located right at hand. The sheet is struck several times with the punch and as often ground off. After repeating this process five or six times the thin film of metal left in the plate can be

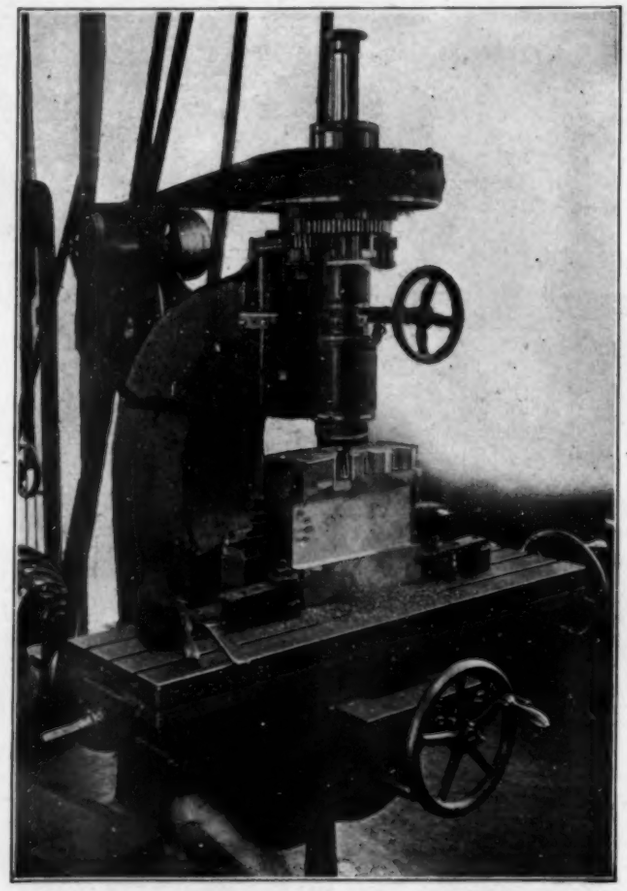


FIG. 14. MILLING BREAKDOWN IN CENTER DIE

pushed out and the die will then be a replica of the master punch not only in outline but in draft.

A round die fitted with a punch in which there is a center hole the size of the rod of which the master punch is made is kept set up in an adjoining foot press. Slipping the master punch into the central hole of this punch it becomes a pilot for locating the piece of metal in which the die is made, so that when the punch is brought down a round piece of a standard size for a certain line of ticket punch is blanked out, having the opening of the new die exactly in its center. After hardening this die it is set in its recess in the ticket punch and staked in by means of a round hollow set, so that one or two blows serve to hold the die firmly in position.

The punch member of the finished tool is a projection upon the movable jaw cast integral with it. With this jaw in place and held by a temporary pivot which for convenience i provided with a handle, the shape of the die is outlined or "set off" with a scriber upon the face of the punch in the same manner that any tool

or die maker would do it. Quickly removing the jaw the operator catches it in a vise and with a set of suitably shaped small chisels cuts the punch to line.

Reassembling the tool and closing it he strikes one or two light blows upon it with a soft hammer, shearing the punch in the die. The jaw is removed and any small burs of metal taken off with a riffle, after which it is put together and tested upon tissue paper, when if it cuts this material clean (and it usually does) the permanent pivot is set and the tool is ready for polishing and plating.

The punch is of course left soft, as there would be no advantage derived from hardening it, whereas it is of distinct advantage to have it soft, as all that is necessary to sharpen it when after long usage it commences to leave a bur in the ticket is to take it apart, strike the face of the punch a smart blow with a hammer to upset it, reassemble the tool and shear the punch in again. Fig. 11 shows the tools used and the position assumed by the workman in cutting these punches.

Some of the dies are quite complicated and of course require considerable time in their making, as the fitting involved increases in geometric rather than in direct ratio to the complication of the figure. For instance, instead of taking twice as long to make two letters on a die as it would to make one it is more than likely to take four times as long. Some of the dies are shown in Fig. 12. The pieces designated at *a*, *b* and *c* are master punches.

Kraeuter & Co. also produce large quantities of drop-forgings for other than its own line, many of the forgings being for the Government and used in the prosecution of the war. Two such dies are shown in Fig. 13. Many small articles are made of complicated shapes that wear out the forming and finishing impressions very quickly, and to avoid the expense of an entire new die each time these impressions require renewal dies are sometimes made as shown in Fig. 14.

In this case the breakdown portions are made in the main die block which is recessed in the center to receive smaller dies which contain the finishing impressions. Thus this portion of the die may be renewed as often as may be required.

The article shown at *e*, Fig. 1, made in the dies shown in Fig. 3, is a general-utility tool called a field picket pin. While its name implies its principal purpose it may also be used as a hammer, a nail puller or as a small crowbar, and at the front where tools of any kind are at a premium it may develop as many lines of usefulness as the proverbial hairpin.

This picket pin, as well as the cutting plier shown at *b*, Fig. 1, was designed especially to meet the requirements of the United States Government, and both are being supplied in large quantities.

China a Market for the American Machine Tool

By L. W. SCHMIDT

China is a virgin field for all kinds of machinery, and the outlook for American machine tools, owing to their quality and reliability, is especially good. Like everything else, however, the volume of this trade will largely be obtained by the ones who get there first with the best and most tools. Machine tools will be most needed for railroad and other repair shops and for road and bridge building. Another factor that should aid trade between the United States and China is the recent extension of the financial and transportation facilities of American express companies. This contribution amplifies the foregoing.

THE growth of local industrial activity, greater reliance on local facilities for construction and repair work and higher wages for labor are factors that have been at work in China tending to revolutionize the machine industry of that country and also exerting their influence on the character of the machine-tool exports of America to China.

In former years China has relied almost entirely on European imports for the majority of her industrial products. Latterly, in many instances, Australian, American and Japanese goods have taken the place of the European articles. Now, however, a new period in the industrial development of China has set in, which has already had far-reaching effects. China with its untold resources has begun to produce European goods on a manufacturing basis.

While factories in China have been making this kind of goods before the war they have always had to fight a very strong European competition, but this competition has practically disappeared and China has to rely on its own industry for most of the goods formerly imported. Local industry consequently has gained immensely in importance, and the factories engaged in the manufacture of merchandise formerly imported from Europe have been extremely busy. Many have extended their facilities, also new ones have developed.

Whenever such a development takes place like that at present in China the machinery industry of the world is the first to feel its effect. Machinery is today needed wherever modern manufacturing methods are introduced, and so the first indication of the changes going on in China has been a keen demand for machinery of all description. Unfortunately for China this demand could not be filled satisfactorily by European and other makers. The war has cornered the industrial forces of Europe and America, and China has to take what is left after the more urgent needs have been provided for.

Notwithstanding these difficulties it seems that the foundation has been laid for the coming industrial forward movement in China and that that country will never return to its prewar stagnation. The machine-tool and general machine-building industry of the world will have in China a new customer of considerable importance. Having once made the beginning in a few

years hence she will have her own machine-building industry. She will have to provide repairing facilities for her new industries and railroads. For all of which the assistance of the modern machine tool is required.

As the use of machinery on a large scale in China has begun at a time when machine construction in the rest of the world has reached considerable development, the Chinese machine shops are enabled to start off with a much better equipment than most of the shops of some other countries. Old machines will not have to be sent to the scrap heap or be taken in part payment. As far as the machine-tool industry is concerned China is virgin ground, and when once she begins to buy she will buy the most modern machinery. This will benefit especially the American machine industry.

The need for labor-saving devices has not so far influenced very much Chinese machine buyers when ordering machine tools. Until recently China was the country of cheap labor, but there are indications now that China also is going to have her labor problem, During the war the wages of skilled laborers in the iron and other industries have risen, and the employment of labor-saving machines has become a necessity. Likewise Chinese labor, which because of the war has been introduced into Europe, most likely will continue to flow in that direction to help make good the loss of man power, so a new situation will arise in the Chinese labor market, which doubtless will also reflect on the use of machinery.

Finally electricity has come to China to stay. It has paved the way for the employment of machines in localities where they would have been impossible a short while ago. China also has a power problem of its own, and where electrical power is not obtainable industry is under the difficulty of providing fuel. The coal supplies are said to be below normal and the local coal deposits have not given much relief, owing to the interruption of railroad communication caused by the revolutionary fighting and the general decay of governmental railroad property during the last few years.

Electrical Power and Industrial Development

The industrial importance of Canton in recent years is due principally to the existence of the fine power plant provided by the Kwantung Electric Supply Co., a Chinese concern. It is just now extending its power plant, and over $400,000 will be spent on new equipment, which is to come almost exclusively from America. Many of the leading cities of China now have electricity, and as a rule the railroads and mines possess their own power plants, which supply the neighborhood with power and light. All of this quickens industrial development by creating new industrial centers with an economical power source that allows the employment of heavier machines that in turn is responsible for the increasing demand for machinery.

Both Hongkong and Shanghai have extensive power plants, and electrical energy is used by all the leading industrial establishments operating in these two places. Hongkong especially has made enormous progress of late years and promises soon to be the best machinery market of continental eastern Asia. The principal cause for the present industrial activity and the corresponding need for machinery in Hongkong of course is the war.

Today Hongkong begins to replace Europe in China in many respects as a manufacturing center for European goods. How far this development has already gone may be seen from the fact that it is now possible to build in Hongkong all the engines and machinery, including main engines, boilers, auxiliary engines, pumps, motors, dynamos and even the great propellers of a 10,000-ton ship. Four big ships were built during the first half of last year, and the local machine shops have coöperated with the shipyards to make a success out of the enterprise. There are in Hongkong quite a number of Chinese and European machine shops that some day will become good customers for American machine tools.

Up to the war the machine-tool equipment of the local machine shops, including the two shipyards, was fit only to make repairs on imported machines and ships. Since the war much repair work had to be done locally, and the strain on the local repair shops and shipyards has become great and the existing equipment insufficient. Also more new construction work is done. Attempts were made by various firms to supplement their machine-tool equipment, but these have not met with very good results. It takes today much longer than before the war to complete a purchase, and when the order is given the delivery is not always prompt.

War Orders

European and American machine-tool builders have their hands full completing war orders, and as these have priority over other business the private customer has to wait. This, of course, is fully realized in China, and delay in deliveries is expected, but the Chinese customer holds that the local manufacturing industry is doing just as much work as that of other countries, and he thinks that he should get more favorable treatment. The quick repair of ships waiting to go to sea again, for instance, is of great importance in the continuation of uninterrupted commerce with the East, and as they cannot be repaired in Europe the work has to be done in Chinese shipyards.

As already pointed out new industries are springing up in Hongkong and other cities of China, and these industries need machinery of various description. In former years these machines had to be imported, of course. Now, where the new industries are a matter of great importance to China, the only thing to do is to see what part of the required machinery can be built in Chinese workshops. The result so far seems to have been encouraging. Hongkong machine shops, for instance, have taken up the construction of internal-combustion engines. Imported machines, of course, could not be entirely dispensed with and have been supplemented by the locally built ones when obtainable, but in Hongkong at least the import value of machines has fallen much below that of normal years. Specialty machines for the textile industry have been less in demand, and old machinery, more carefully repaired, has had to do additional work.

The decline in the imports of machinery has not been the same all over China. Where the facilities for manufacturing machines and repairing old ones were not available new machines had to be obtained at any cost. So in Hankow, where the expansion of the iron and smelting industry has become a matter of urgency, iron-working and smelting machinery to the sum of

$234,000 was imported during 1916. The railway repair shops, which had imported machinery, especially machine tools, to the extent of $46,000 in 1914 purchased $34,000 worth of machines during the two following years. The demand for power machinery was also very active.

The most extensive users of machine tools in China and those always willing to buy new and up-to-date tools are the railroads. Most of the Chinese railroads are under partial or full control of European engineers, and all have excellently equipped repair shops which now are called upon to do a good deal of new-construction work. Before the war the Chinese railroads found it to their advantage to buy their rolling stock and track material from Europe, but while their machine equipment today is still not complete enough to allow them to dismiss European help entirely great progress in local construction has been made. Locomotives still have to be bought abroad for the most part, and as it is difficult to get new locomotives delivered promptly from Europe, American locomotives are now more in demand. Only recently an American company supplied five new freight-train locomotives of the Mikado type to the Peking & Mukden R.R., and the company has ordered 14 other locomotives of the same type.

Manchurian Railway Shops

The railroad construction shops of the Manchuria Railway in Dairen are building many of the steam locomotives required by that road, and they have also taken up the construction of electric locomotives, several of which were turned out recently. These locomotives are to be used in mines. The great construction shops of the Manchurian Railway belong to the best of their class in Asia. The grounds of this very fine plant cover more than 200 acres, and 2800 men are employed, one-half of whom are Japanese and the other half Chinese. The technical staff also is quite large, 50 draftsmen being employed. The buildings cover 16 acres.

This plant is very busy all the year round, as it cares for the repair of nearly 300 locomotives, 3400 passenger cars and a correspondingly large number of freight cars. A description of these shops published in the *Far Eastern Review* mentions the most important of the machine tools in use. For the information of those who may wish to get the business of the Chinese railway repair shops this list is here repeated.

In the boiler shops there are a riveting tower, three portable hydraulic riveting machines, several drilling machines, radial arm drills, boiler-tube and sheet drilling machines, a plate-edge planing machine, plate-bending rolls, a boiler-shell drilling machine, several shearing and punching machines and a hydraulic press. The engine-erecting and machine shops are 444 ft. long and 190 ft. wide, and contain one large and several small planing machines, a cylinder-boring machine, radial drilling machines and surface-grinding, boring, turning, milling, shaping and slotting machines of various designs. There are big lathes for engine and car wheels and an electric annealing and tempering furnace. In the smithy and forge shop are 10 assorted steel hammers, including one 60-cwt. 150-ton hydraulic forging press, a big punching and shearing machine, a hydraulic spring-buckle press, two bolt and rivet head-making machines, one forging machine and drop hammers.

The equipment in other railroad repair shops does not appear to be as extensive. The size of the railroad and repair work which has to be done every year, of course, has guided the engineers in laying out the construction and repair shops of each individual railroad, and these considerations also have affected the machine-tool equipment. The Chinese railroads did not buy much new equipment during the last years because of the war and the generally not very favorable condition of the Chinese railroads, which have suffered a great deal owing to the unsettled state of the country. For the same reason repair work has been very plentiful. Great troop transports have been necessary during the past years, and these have taxed the railroads to a considerable extent, especially as the Chinese soldier is known as being a very destructive passenger. Cars used for troop transports very often have practically to be refitted before they can be used again for ordinary traffic.

Influence of Japan

Japanese influence on the machine-tool trade of China so far has remained small. The Japanese machine-tool builders are turning out some of the simpler machine tools with fair ability and at a cheap price. Customers, however, who are looking for exactness in their work prefer the better made American or high-class European machine tool. With reference to ordinary mechanic's tools, however, the Japanese have made good progress, this being especially so of their cutting tools, as Japan has taken over the German railroads and their repair shops. This has been a good advertisement for the Japanese machine-tool builders in China.

One of the reasons why Japanese machine tools are not so frequently found in China is the inability of Japan to participate in the international loans given to China before the war.

Loan Policy of European Countries an Influence In Chinese Machine-Tool Trade

No doubt the financial assistance given for many years by the European governments to China has had a good deal to do with the sale of European machinery and railroad material in China. Most of the loans given by the European banks have been so-called railroad loans or have been secured by railroads. The agreements made for the purpose of effecting the loans always contain a stipulation that certain of the constructing and managing engineers of the railroad should be citizens of the country giving the loan. Naturally these engineers, wherever possible, have given preference to the machine tools made in their own country. So we find that most of the machine tools used in the railroad repair shops of the German-Chinese railroads are German, the same being true of the railroads under English and French control.

Japan had taken part in the arrangements of the now defunct Six Power loan only as a minor partner, and Japanese private financiers also had invested capital in many industrial enterprises in China. But the real entrance of Japanese capital into Chinese industrial enterprises dates only from the fall of the fortress of Kiaochau. By this event the Japanese acquired practically the control of the prewar German interests, which, added to her other great holdings, immediately gave her a powerful financial and commercial position in

China. Of this its manufacturers and merchants are now making a very good use. The great Japanese financial firms of Mitsui, Furukawa, Okura, Kuhara, Suzuki and the Toa Kogyo Kaisha have combined for the purpose of developing the industrial possibilities of certain parts of China, which soon will show its effect on the industrial life of China. So far it seems that the electrical industry has reaped the benefit of this new combination.

Japanese machine-tool builders also expect an addition to their business in consequence of the newly begun extension of the Mongolian railroad system which is under Japanese control. This enterprise also should bring business to the American machine-tool builders, as certainly part of the machine-tool equipment for the new railroads will have to be ordered in the United States. Japanese engineers have always appreciated the good quality of the American machine tool.

German Dealers in China

The Germans, who have been selling many machines in China before the war, will most likely not be as successful in the future. The German machine business in China before the war was conducted by large importing houses that had branches all over China. With these the German machinery dealers, who also often sold American and English machines, were able to make concessions to the buyer which could not be secured by dealing direct with the principal. The German machine business in China has been carried on largely by the trade-acceptance plan, and French and English capital have helped to make this a success, notwithstanding English machinery exporters have been averse to allowing extended credits to the native machinery consumer. This system of trade credit may return after the war. At present the Chinese buyer of a new machine tool has to pay cash. This is a great disadvantage to him, but the firms which insist on cash payments have not had much difficulty in gaining their point.

Future of Chinese Trade

The immediate future of the Chinese machinery trade, of course, is closely connected with the war. The principal question is whether China will be able to hold out against the returning European competition after the war, or whether the young industry which it has developed during the last years will be sufficiently established for itself. The opinion of men close to Chinese affairs is that China has made only a beginning and that much more can be expected of her. They think for instance, that much business will flow to the local iron industry in China when the great national program of road reform has been taken up seriously. Today China is traversed by numerous roads that will have to be reconstructed according to modern ideas. Where this reconstruction has already begun it has led to good results. Iron and stone bridges have replaced the old structures, and with the growth of the national iron industry there is to be expected that the iron bridge finally will be the standard bridge of Chinese road building. This will bring employment to the Chinese bridge builders who until now could look for orders practically only to the railroads.

How far the American machine-tool and general machinery industry will be benefited by this development in China depends entirely on the American machine-tool builder. America is now to participate in an international loan to be extended to China, and this change in American official policy will soon bear fruit with reference to the commercial relations between the two countries. American banks are operating all over China and by doing so have facilitated the intercourse between seller and buyer. Finally, the American express companies have secured a foothold in China.

Banking and Express Facilities Extended

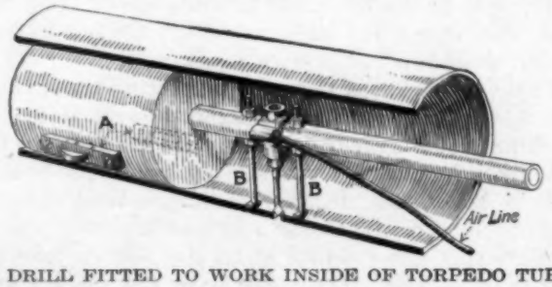
One of the great drawbacks in the use of imported machinery everywhere in the world is the difficulty of making repairs when complicated parts are broken. The larger factories, of course, have the means of repairing their machines, but in any case the best thing to do is to get as quickly as possible an exchange part from the factory. The shipping of these parts and the arrangement for payment has always been a complicated matter, and the war has increased these difficulties. It must therefore be a matter of satisfaction to the American machine industry that it can make use now of the facilities offered by several of the large American express companies, which have opened agencies in Hongkong and Shanghai for the transaction of all kind of transport business and the payment of money. The full benefit of this expansion of the business of the American express companies to eastern Asia, of course, will only appear after the war.

No doubt there is in the making in China a big market for the machine tools manufactured in the United States. It is desirable that this fact should be recognized early in this country in order to have the American machine-tool industry firmly established in the market when the great forward movement that is expected sets in.

Countersinking Holes on Inside of Torpedo Tubes

By Frank T. Schell

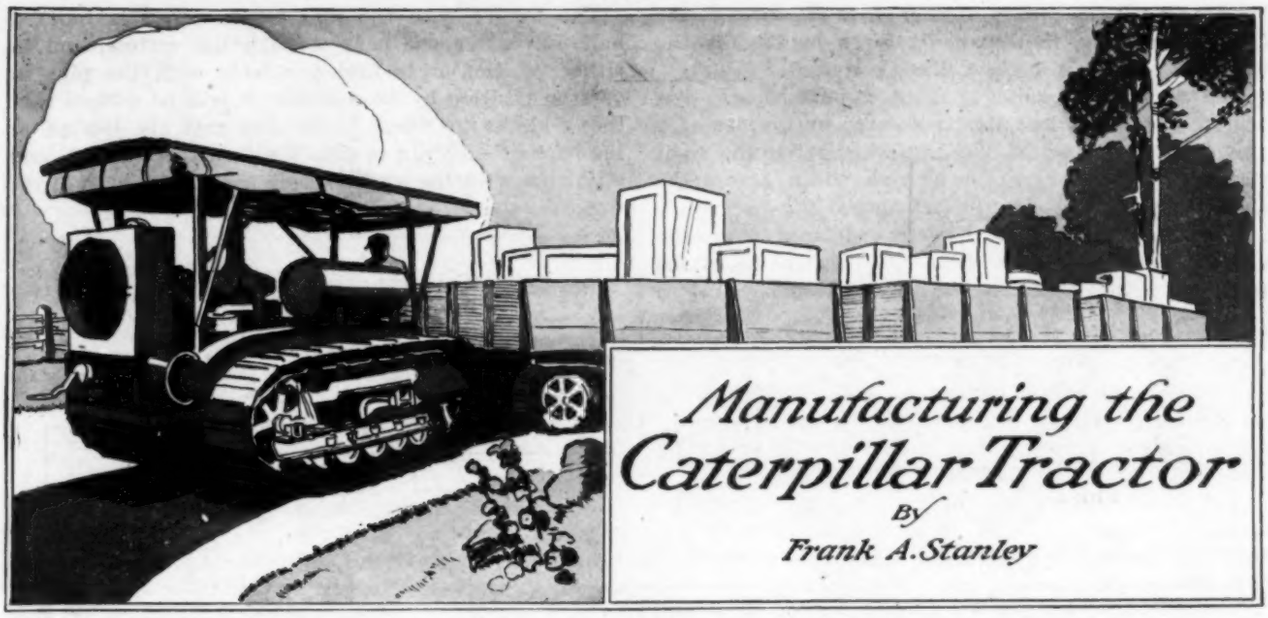
The illustration shows an arrangement that was designed for the purpose of countersinking the rivet holes on the inside of torpedo-deck tubes. These tubes are



AIR DRILL FITTED TO WORK INSIDE OF TORPEDO TUBE

18 ft. long, 21 in. inside diameter, and there are about 300 holes in each tube.

It was a rather difficult proposition for a man to get inside the tube to manipulate an air drill. So the air drill was fastened to a cylindrical weight and fitted with a pipe handle. A pair of rollers *A* were fastened about 30 deg. apart to the weight, and a couple of adjustable studs *B* were provided to regulate the depth of the countersink.



Manufacturing the Caterpillar Tractor

By Frank A. Stanley

III. Milling Work

This installment includes index milling of clutch members, string milling of chain pins, straddle milling of brackets, and various other operations carried out with special fixtures. Details of tools are covered along with description of the work itself.

A NUMBER of interesting milling operations as performed on various component parts of the "Caterpillar" tractor are illustrated by the halftone and line engravings appearing in this article. The methods followed in the manufacture of these tractors contain many features of importance from the point of economical and effective production, and this applies to the milling department as well as to the other sections of the factory. Some of the methods in milling heavy work, such as crankcases and the like, have already been described in these columns, and following this article there will be special description of certain other classes of milling.

The present article deals with a variety of work where milling cuts are required on all sorts of surfaces and where special fixtures are applied to great advantage in facilitating the handling of the pieces in the machines.

Fig. 15 illustrates an indexing fixture used on the table of a column-milling machine for cutting four equally spaced rectangular notches in the periphery of a ring that forms part of a disk clutch, or coupling.

The fixture consists of a baseplate upon which is mounted on a central post a round table for carrying the work. The flange on the lower part of the work carrier is provided with indexing notches to suit an index latch at the front of the baseplate, and the latter plate carries also a clamp device in the form of a binder handle for gripping the rotating table securely after each indexing movement, thus obviating chatter during the taking of the cut. This binder is shown at the left of the base immediately under the point where the cutter acts upon the work.

The top of the fixture is about six inches above the

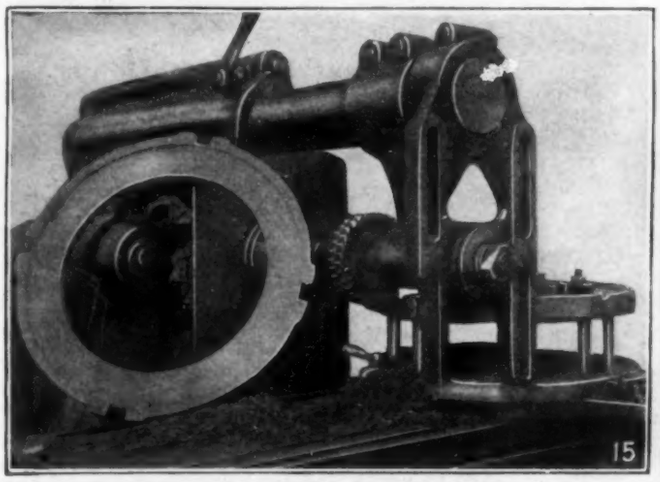


FIG. 15. INDEXING FIXTURE

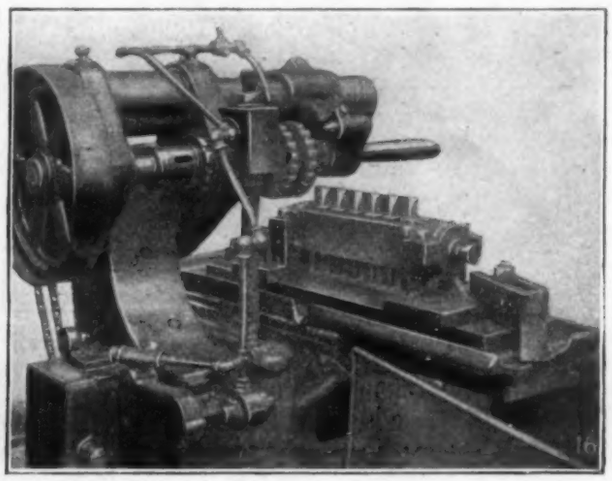


FIG. 16. MILLING A STRING OF CHAIN PINS

base to permit the cutters to clear when fed through the edge of the ring, the cut being taken by feeding the work upward against the milling cutters.

The width of the slots, or notches, must be held to a definite dimension, and this is assured by the use of a pair of side mills which may be packed out to the right distance apart to keep the over-all width across the outer faces of the teeth to exact figure.

The ring to be notched is bored and faced before the milling operation is performed, and the locating of the work upon the fixture is readily accomplished by a

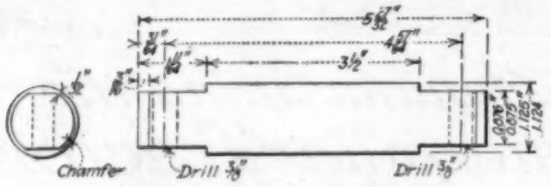
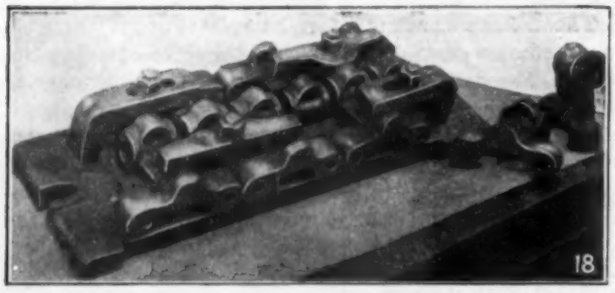


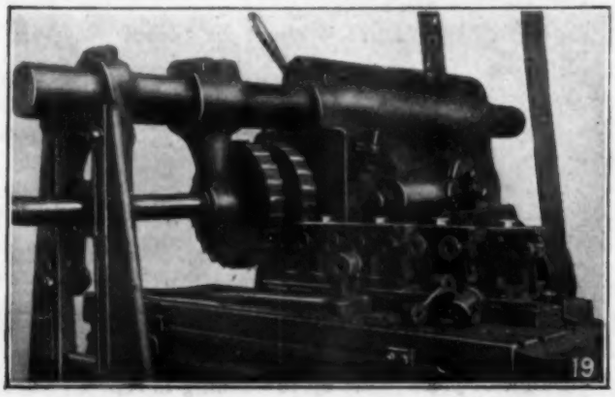
FIG. 17. DETAIL OF CHAIN PIN

central hub, or shoulder, which enters the interior of the ring.

The illustration in Fig. 16 shows a method of milling at one setting a number of steel pins which have to be flatted on opposite sides and at both ends. The pins are of cold-rolled stock, and after milling and drilling the pieces are casehardened. They are used in the first-motion chain of the "Caterpillar" tractor, and the dimensions in general are given in the drawing Fig. 17.

Six of these pins are held in the milling fixture at once, where they are secured in V-shaped seats with their ends projecting to uniform distance from the center so that the flats will be milled alike on both ends





FIGS. 18 AND 19. MILLING FIXTURE AND OPERATION
Fig. 18—Fixture for milling bottoms of rocker-arm brackets.
Fig. 19—Milling tops of rocker-arm brackets

of all pins in the series. The holding fixture is provided with suitable trunnions which mount it centrally in the supporting brackets clamped to the table of the milling machine.

The fixture with the pins to be milled is indexed half over after one pass through the cutters, and in either position it is held positively with the pins in vertical position by fixed stops. It will be noticed that the V-blocks in which these pins rest are located at the back of each pin to take the thrust of the cut, and all blocks with the work therein are set up to grip the

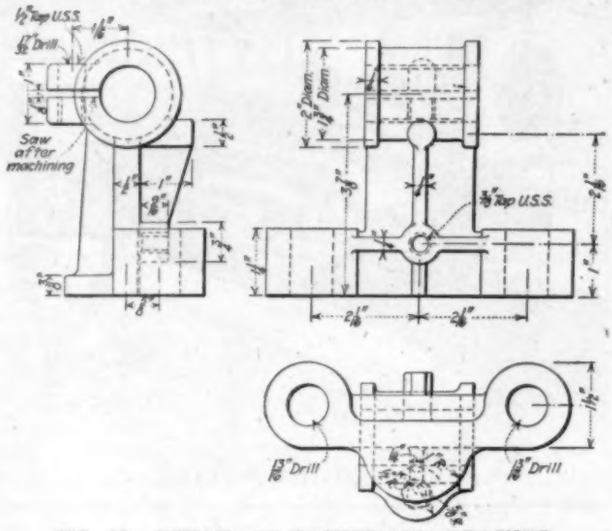


FIG. 20. DETAIL OF ROCKER-ARM BRACKET

pins by the screw tapped into the end of the trunnion at the right-hand end of the device.

In Figs. 18 and 19 two fixtures are shown for two different milling operations on the rocker-arm bracket shown in detail in Fig. 20.

The first-milling operation is accomplished in the fixture shown in Fig. 18, where the bottom surfaces of six castings are machined at one cut. The fixture consists of a heavy baseplate, along the center of which is a V-shaped channel to receive and locate the round upper

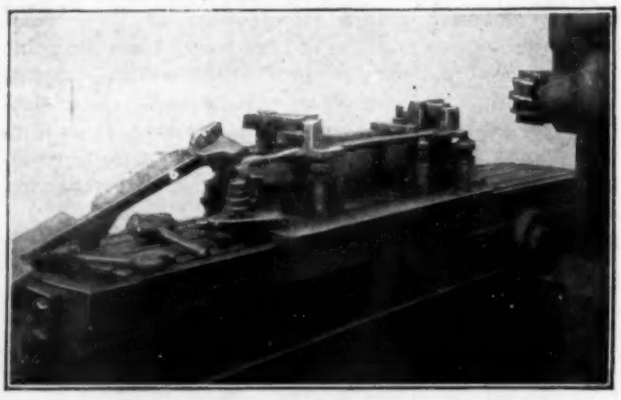


FIG. 23. MILLING THE MAGNETO BRACKET

ends of the brackets. The six castings are placed bottom ends out alternately, one to the right, then one to the left, so that three bases are exposed over each edge of the fixture where they can be machined by a pair of straddle mills and the whole six surfaced on the bottom.

The next milling operation is carried out with the aid of the fixture shown on the machine in Fig. 19. Here eight brackets are set up on their milled bases and secured by four clamps for the milling of the tops of the castings to width and the upper surfaces of the bases to thickness.

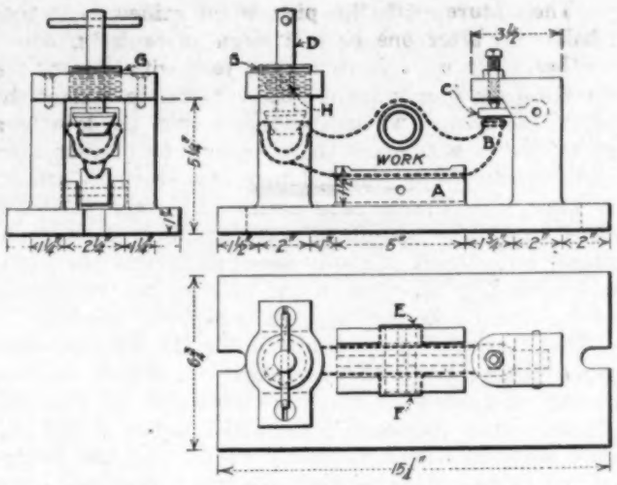


FIG. 21. A ROCKER-ARM FIXTURE

The method of securing the work to the fixture is clearly shown. The straps used between each pair of brackets leave the ends clear for the cutters to operate on, and the tops of the bases are also in correct position for milling at the same pass of the cutters so that one operation accomplishes the facing of the four surfaces; that is, the two ends straddle-milled at the top and the two projections on the base surfaced with the outside teeth of the cutters. The rocker arm used with these brackets is of the form shown in connection with the fixture in Fig. 21. The straddle-milling of the two side bosses near the middle of this rocker arm is done in this fixture, which is constructed as follows: The base is provided at the middle with a channel $\frac{7}{8}$ in. wide in which is fitted a long V-shoe *A*, which is hung on a pin and adapted to receive the back of the rocker arm and center it sidewise, at the same time permitting of enough rocking motion to allow the work to be correctly positioned in respect to the up-and-down location of its ends. The short end of the rocker arm at *B* comes up against a stop *C* which is in the form of a pivoted plate abutting against an adjustable stop screw which once set is not ordinarily readjusted unless some change in the castings necessitates such resetting. The long end of the work is pressed downward into the pivoted V-shoe *A* by the conical ended plunger *D*, which fits into the spherical mouth of the work at this point, and when this end is depressed, the rocking action of the shoe about its pivot brings the short end of the work snugly against the stop plate and screw referred to and the piece is then fed between the straddle mills for finishing the two side bosses *E* and *F*.

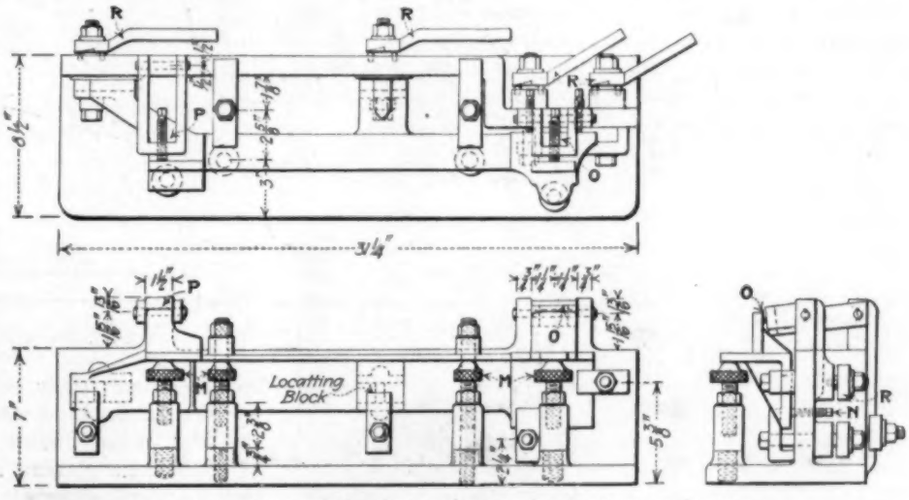


FIG. 24. CONSTRUCTION OF BRACKET-MILLING FIXTURE

Quick-Acting Arrangement

The clamping plunger *D* has a quick-acting feature of interesting design, which is a combined locating cone and plunger that is pushed down directly into the mouth of the rocker arm and a screw which with a fraction of a turn secures the work firmly in position. This is made possible by making the plunger *D* a sliding fit in the threaded bushing, or sleeve, *G*, and forming a means of connecting the two by a short pin fastened in the plunger and engaging in a groove cut inside the bore of the sleeve. The groove is cut way down the bushing straight like a keyway and then turns at a right angle for a distance of about 60 deg. as indicated at *H*. When the plunger is pushed down into the bushing its pin follows to the bottom of the groove and then a partial turn of the plunger handle to the right engages the pin with the annular portion of the groove, and the plunger and threaded bushing then act as an integral clamping screw for holding the work.

Similarly, in releasing the work, the plunger when given a sixth of a turn to the left brings its cross-pin against the back of the annular portion of the locking groove in the bushing and a slight movement further unscrews the bushing and releases the work in the fixture, the plunger then being pulled up out of the way for the placing of the next rocker arm.

A difficult piece to set up for milling is represented in Fig. 22, which shows a cast-iron magneto bracket with various projections in the way of lugs and bosses that necessitate a milling fixture provided with adequate supporting devices for different portions of the casting in order to assure satisfactory results. The fixture developed for this purpose is illustrated in use on the milling machine in Fig. 23, and details are given in Fig.

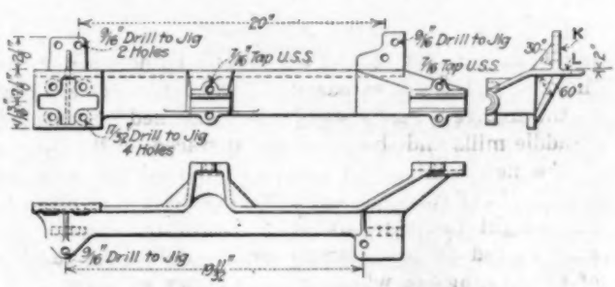


FIG. 22. DETAIL OF MAGNETO BRACKET

24. As constructed this fixture allows the work to be located, clamped quickly and secured against springing under the action of the cut.

The milling operation performed in this fixture is the facing of the bearing surfaces at *K* and *L*, Fig. 22,

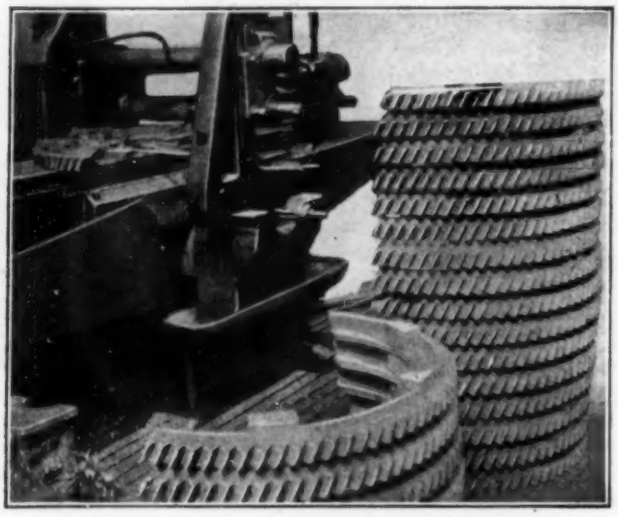


FIG. 25. MILLING STEERING SEGMENTS

the latter being at an angle of a couple of degrees from the right-angle relation to surface *K*, so the cut in milling out the two seats at the ends of the bracket is taken with a mill which is tapered to the above angle of slope and a single cut finishes both surfaces.

Referring again to Fig. 24 it will be seen that the work rests in the fixture upon four stop screws *M*

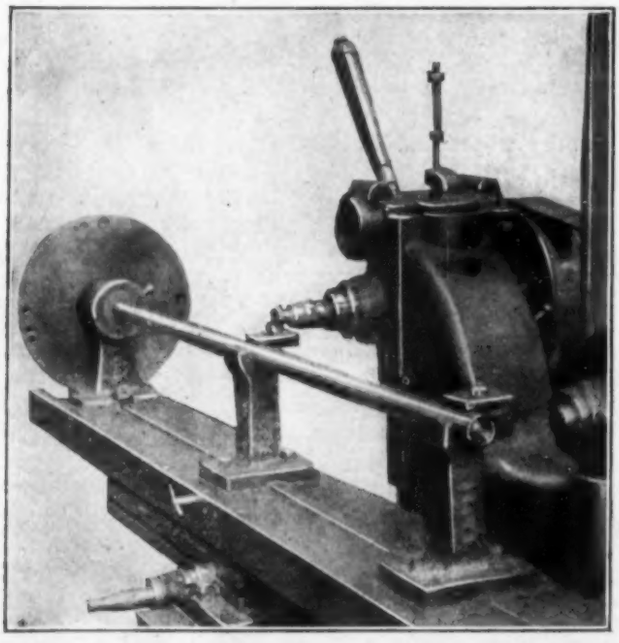


FIG. 27. FIXTURE FOR MILLING KEYWAYS IN CAMSHAFT

which are located under the points where milling is to be done. Behind the work and near the bottom edge are stop screws *N*, and at the top there are other stops carried in the swinging arms *O* and *P* which are so pivoted upon horizontal pins as to be swung up out of the way to clear the work when it is ready to be removed and then dropped to place again after a new piece has been put in the fixture for milling. At the back of the fixture there is a series of binder handles for operating the clamps on the face of the work to draw it back snugly against the various stops referred to. These binders, as seen at *R*, act upon the principle of a face cam and are short enough to prevent any undue stress being imposed upon the work to deflect it when it is drawn back against its stops. At the same time they permit of very rapid operation, and proper adjustment of clamp pressure against the work is always feasible through the nuts on the rear ends of the clamp bolts carrying the cam binder handles.

The steering-gear segments in Fig. 25 are cast with three bosses, or lugs, along the rim which require facing off to definite height as indicated by Fig. 26. These castings are made to an outside radius of 38.8 in., or a distance across of nearly 6½ ft., and the facing of the three projecting pads by which they are later

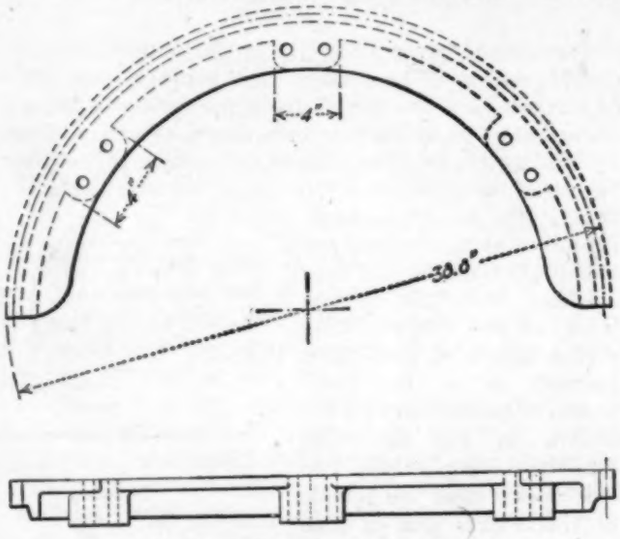


FIG. 26. SEGMENT DIMENSIONS

mounted upon their brackets presents an interesting problem in machine work, as the small, widely spaced surfaces to be finished make the job inpracticable for handling on a planing machine or vertical boring mill, and the dimensions of the castings are such that the ordinary size of column-milling machine is of insufficient capacity for carrying the work. So the castings are handled on a horizontal milling machine, as illustrated in Fig. 25, where two slabbing cutters are placed on the arbor which cover sufficient width of cut to enable the work to be placed lengthwise on the platen and fed straight under the mills, the table being traversed rapidly between the actual cutting sections to eliminate time loss.

HAND MILLING

The operation shown in Fig. 27 is the cutting of the keyway in a camshaft for the eight inlet and exhaust cams, these cuts being made for No. 15 Woodruff keys. A hand miller is employed for the work, and this is fitted up with a special table and fixture for locating all keyways in the exact positions required in relation to each other and also in reference to the keyway for the timing gear which is milled previously to the placing of the shaft in this fixture.

Fig. 28 shows the positions of all cams, both longi-

tudinally on the shaft and in angular relationship about the axis. This shaft, by the way, is only one of several sizes taken care of by the same keyway fixture.

The special table forming the base of this fixture is about five feet long and carries an auxiliary table, or slide, which is mounted in a guideway planed in the top face of the main table. The upper slide carries the holding devices for the work, these consisting of an index head and two supports for the middle and outer end of the camshaft. The index-head spindle has a sleeve chuck in which the work is located by its main keyway,

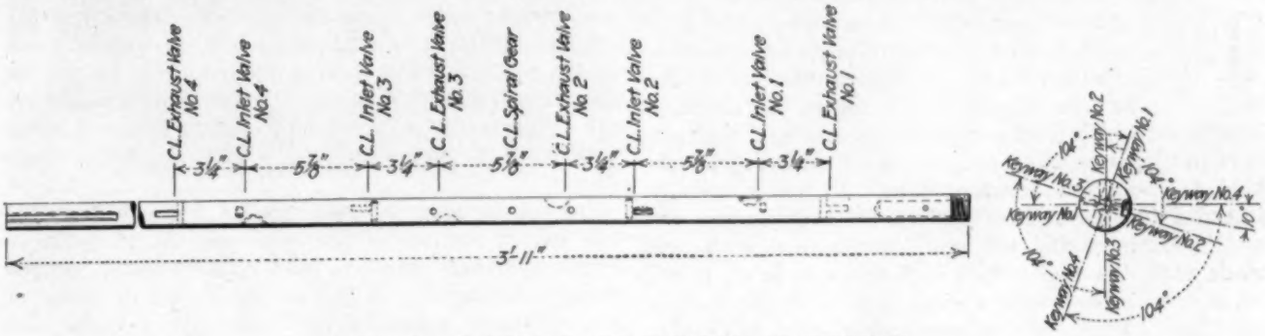


FIG. 28. CAMSHAFT AND LOCATION OF KEYWAYS

and at the rear end of the spindle there is an index plate for setting the spindle and shaft to the necessary angles for the different cam keyways.

The auxiliary table carrying these fixtures is provided with a series of index lines and holes, and into these openings a locking plug seen at the front in the illustration is adapted to be slipped for setting the table to the different longitudinal positions for the lengthwise spacing of successive keyways. The machine once set for a given type of camshaft the operation of the apparatus consists in sinking the mill into the shaft for the first keyway, advancing the table to the next longitudinal station and locking it with the index pin, then indexing the head spindle and work by means of the index plate on the spindle and cutting the next keyway. This procedure is repeated until the eight keyways have been sunk, an operation requiring little time and giving very accurate results.

The relative locations of the various keyways along the shaft are given on Fig. 28 and the corresponding movements of fixture table and indexing head will be understood after inspection of the illustration.

Hand Versus Power Feed in Surface Grinding

BY DONALD BAKER

Because of the lack of knowledge by toolmakers of the proper grain and grades of wheel to use for different materials and under varying conditions and their uncertainty in the matter of feed and depth of cut, surface grinding is usually a time-wasting proposition.

When using the ordinary form of surface-grinding machine with let us say a ½ x 7-in. wheel the average toolmaker will take a cut anywhere from 0.0005 to 0.005 deep with a feed of $\frac{1}{16}$ in. or less. He will of course use the power feed, and this will give him plenty of time to sit back and rest, which will in turn give him an excuse to take light cuts and feeds, justifying them with the plea that he can get better results in this manner.

From an analysis of conditions that obtain in one of the largest tool shops in the country where the power feeds have all been removed from the class of machinery under discussion it would seem to me that such power feeds are unnecessary unless the machines are to be used for regular production on a manufacturing basis. As a matter of fact it has been satisfactorily demonstrated that more and better work will result by compelling the users to feed by hand.

There are several reasons for this. The grinding machine is not a pleasant one to run at best, and no one works on them any longer than he is obliged to, so that if compelled to stand over the machine and operate it by hand he will be ambitious to get the job done as quickly as possible. Further, being entirely dependent upon the hand feed, one soon becomes accustomed to the "feel" of the wheel, thus quickly learning what each wheel is capable of doing under the different conditions.

The fine feeds and deep cuts prevailing when the power feeds are used soon give way to lighter cuts and coarse feeds with eminently satisfactory results.

Some toolmakers have the idea that fine feeds are necessary in order to produce accurate work, but such is by no means the case. Surface grinding may be compared to the finishing of surfaces of cast iron on the planing machine, where it is found that the most successful results are obtained by using a broad, flat-nosed tool and feeding nearly the width of the tool at each stroke.

This same principle is equally adaptable to a grinding wheel. The wheel should be carefully trued with a sharp diamond and then while taking comparatively light cuts a feed should be used that is equal to about nine-tenths of the wheel width. If the wheel is properly suited to the work more stock may be removed by this method with less danger of heating and distortion of the work than by any other method, and it will be found that the product is easier to lap.

With deep cuts and fine feeds the largest amount of wear is put upon the corners of the wheel which, being fed first in one direction and then the other with relation to the work, soon assumes a more or less rounding surface while as the actual grinding or removal of stock is all concentrated in one narrow strip there is not the opportunity for distribution of heat that there is in the case of a wheel that removes an equal amount of stock at each pass but which spreads the cut over nearly the entire wheel face.

Manufacturing a Shorthand Machine—II

By M. E. HOAG

While die castings are used to a considerable extent in the National shorthand machine it has been advisable to replace one of these parts with a sheet-steel punching formed to shape, as described in this article.

THE type bars, or levers, described in the first installment of this article are made with a semi-circular notch on the underside, resting on the shaft *A* shown in Fig. 9, which forms the pivot or bearing on which they work. In order to hold the type bars in proper position and alignment, spacers of some kind are required between them. It was originally intended to secure these desired features by the use of die castings, and the piece shown in Fig. 9 was made with the two slotted sections cast solid, afterward slitting them with a gang of saws on the milling machine. Much trouble was experienced with this method by reason of the saws crowding the narrow sections of metal out of position. Also, owing to the fact that the stock used for the keybars varied slightly in thickness, it was hard to assemble them in the comb without grinding them to exact thickness on a surface grinding machine—in itself an expensive operation—or spending considerable time in selecting bars of an even thickness. For these reasons, and also to reduce the weight of the machine, the die casting was altered so that all of the heavy portions were removed and replaced by thin sheet-steel combs as shown in the illustration, the sections of which are sufficiently flexible to permit crowding slightly by over-thick keybars, the whole line of bars equalizing in such a way that neither grinding nor careful selection is required.

The first punching die for the comb blanks it out as shown at *A*, Fig. 10, which also shows the comb finished ready for assembling at *B*.

The next operation after blanking is slotting. This is done in a pillar die, the base of which carries a steel insert, as shown in Fig. 11, for the slots, and constitutes the die proper. It also carries a frame with guides *A* and an indexing stop *B*, which guide and index the slide *C*, which carries the blank. This slide with blank in place is well shown in Fig. 12. It will be noticed that there are four round holes, in the right-hand edge of this slide, these holes being for the pin on the indexing lever shown at *B* in Fig. 11.

The punch for this work, as shown in Fig. 13, carries the stripper plate *A* and 26 punches. These punches are straight for a short distance and are ground down in the center. This secures the required amount of shear and relieves most of the strain which would result from punching such a long, narrow piece of metal with a flat-faced punch, and greatly lengthens their life.

It will be seen by reference to Fig. 10 that the two slotted portions of the comb are not of the same length and that there is a solid strip of metal between these two portions. A die to handle all of these at one operation would be very expensive to build and maintain, and the amount of stock to be removed would be greater than the thin punches could stand, so to secure both sets of slots with the one punch and die the frame and indexing device are used as follows: A blank is placed in the slide and the slide inserted in the frame and pressed forward until the index pin engages the first hole *A*, Fig. 12, and the slots punched. The slide is then advanced to *B*, and the partly formed slots are finished to the required length. The slide is again advanced to *C* and *D*, and the second set of slots are punched in the same way as the first, which leaves the piece ready for the bending and forming dies.

The bending dies for the comb are unique in construction and accomplish a twofold purpose. They bend the blank to the required form and keep the thin strips of metal in alignment, and they also have a swaging action which removes all burs from the finished piece, thus making filing or other fitting unnecessary.

The first set of dies grips the solid strip of metal in the center of the comb and draws it up as shown in Fig. 14. The punch and dies for this operation

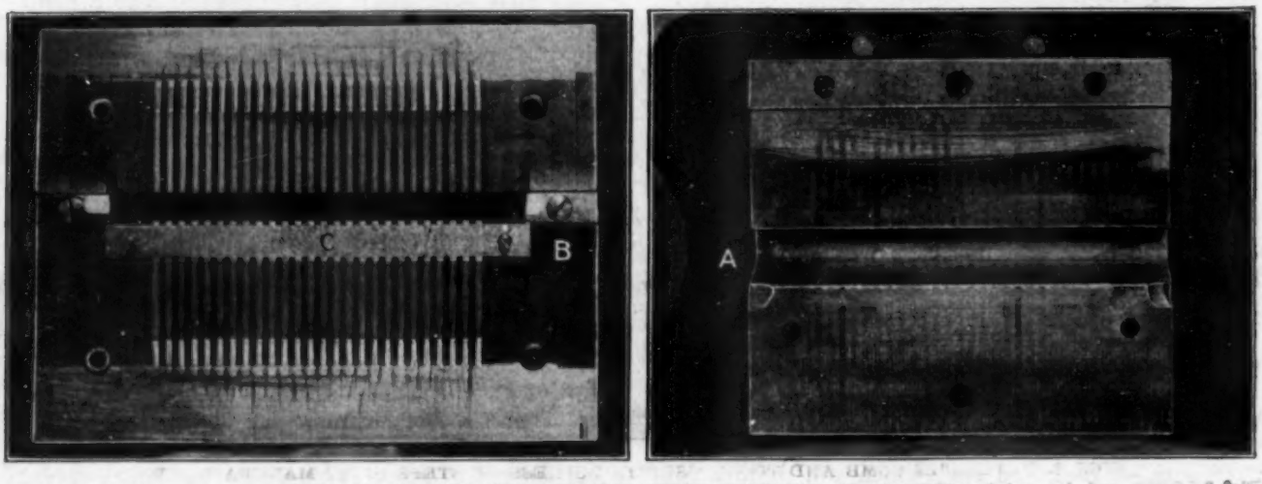
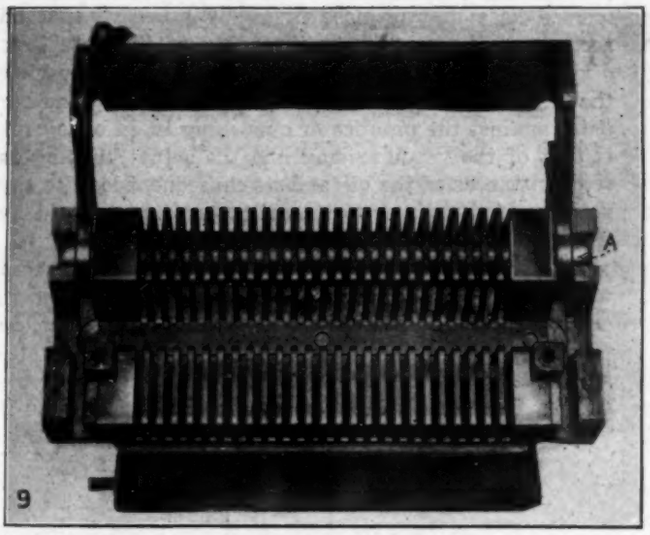
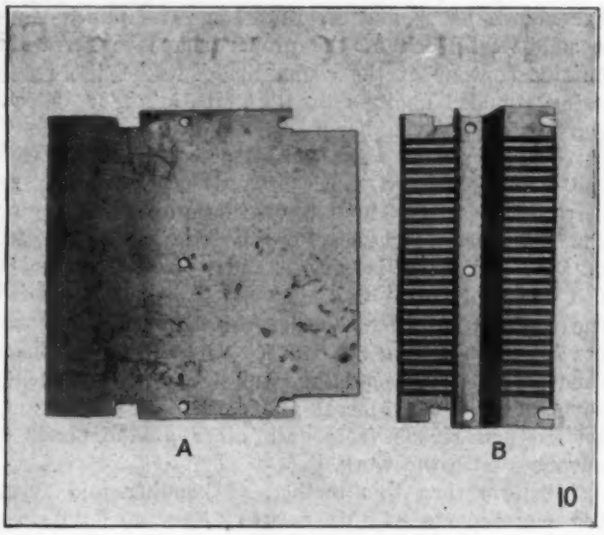
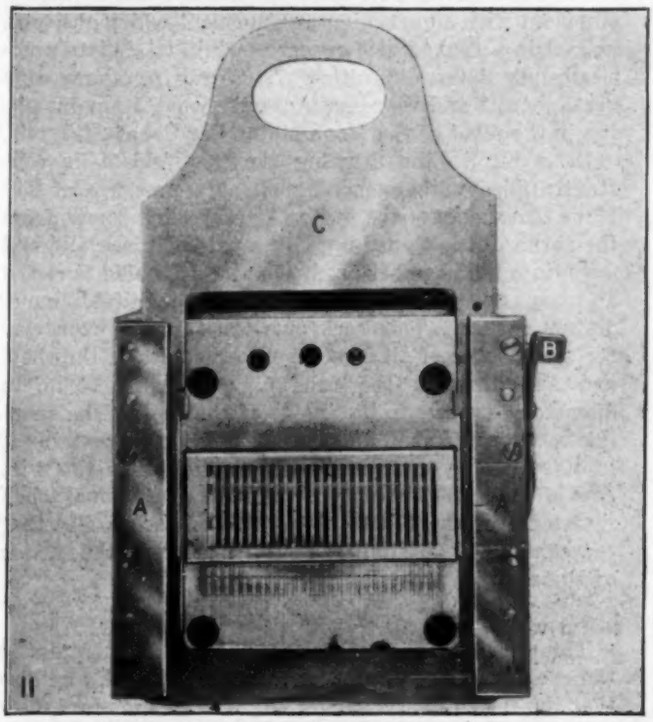
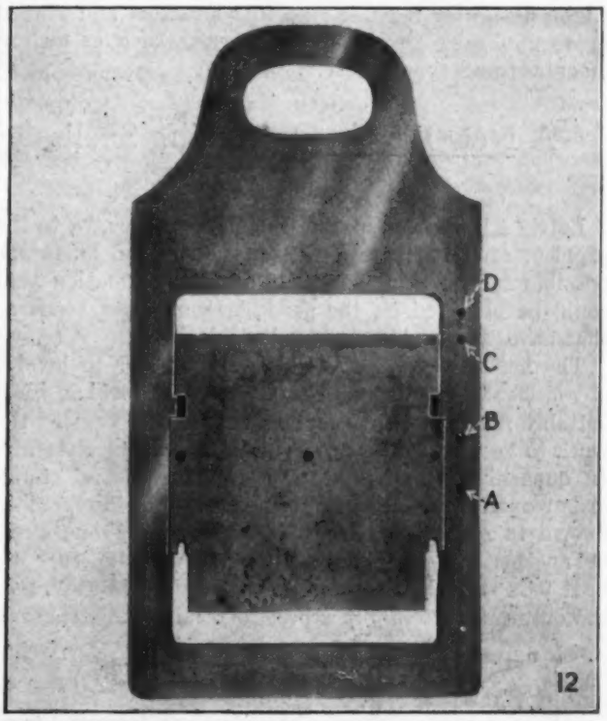


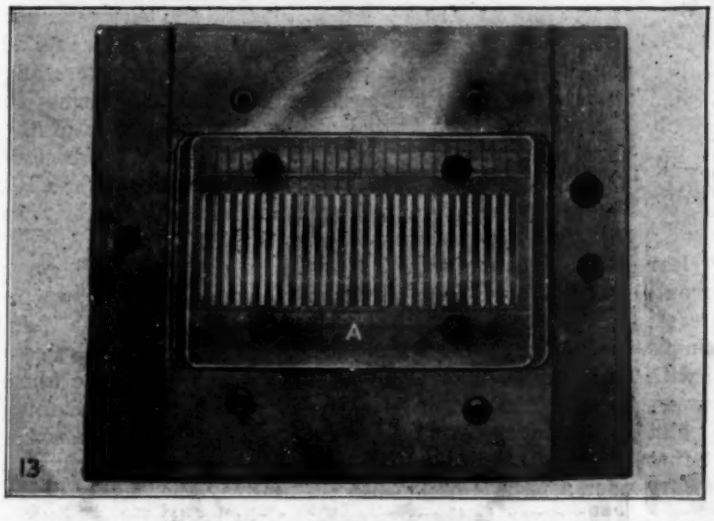
FIG. 15. PUNCH AND DIES FOR FIRST BENDING OPERATION

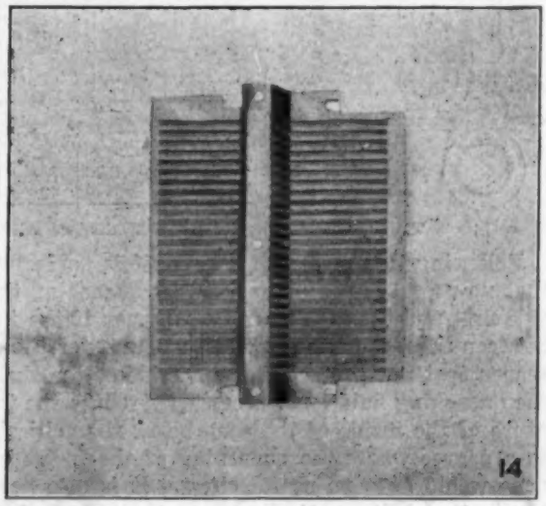












FIGS. 9 TO 14. THE COMB AND TOOLS USED IN SUCCESSIVE STEPS OF IT MANUFACTURE

Fig. 9—Comb and die-cast base assembled. Fig. 10—Finished comb and blank. Fig. 11—Slotting die for comb. Fig. 12—Slide or holding comb blank in die. Fig. 13—Slotting punch. Fig. 4—First bending operation on comb

are shown at *A* and *B*, Fig. 15. The punch *A* is a solid-steel block of the proper shape to form the outside contour of the comb, the edges of the recess being rounded as in a drawing die in order to ease the stock over the bend. The dies *B* are made in three main pieces. The central piece *C* is flush with the side pieces and carries two locating pins to receive the blank. The top of this piece is flat, but the sides are notched to receive the slotted portion of the blank as it is carried down over the edges by the punch *A*. The two side plates are also notched, the tongues entering the slots in the blank and supporting them during the bending or drawing operation, thus acting as stripper or compression plates. Heavy springs allow the central and side pieces to advance toward and recede from each other as the punch *A* advances with the work.

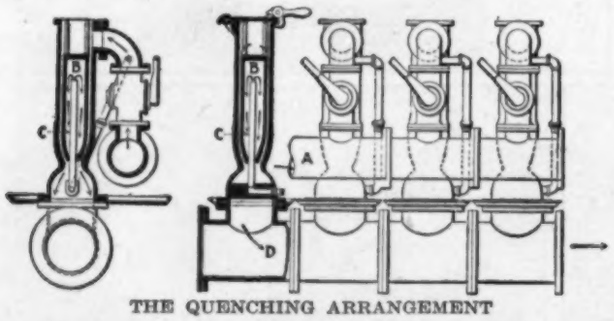
I believe that this method of bending and forming metal parts of this nature after punching is a slight deviation from the regular practice and should prove applicable to other similar work such as adding machines and typewriters.

A New Idea in Quenching Shells

By Harvey E. Brown
Consulting Engineer Moon Motor Car Co.

Lately I have been giving considerable thought to the problem of heat-treating 155-mm. shells and as far as possible I have availed myself of all information that could be obtained on the subject from other concerns that have this problem under consideration.

The heating of the shells does not appear to involve any difficulty, as furnaces are obtainable which when suitably fitted with pyrometers enable this part of the work to be accomplished with uniformity and certainty. In quenching, however, it appears there is no standard or uniform practice, all, or nearly all, of the methods known to me being open to criticism from one angle or another. Having built up a correct structure by heat it is logical to assume that a very rapid cooling is the only way one might expect to retain this structure.



THE QUENCHING ARRANGEMENT

Following this reasoning I think it is perfectly clear that no useful purpose is served by quenching the outside first and the inside afterward, even if the interval between them is of the smallest amount, for the simple reason that any contact of the outside of the shell with the quenching fluid must necessarily reduce the temperature of the inside of the shell below the critical point to a degree where the quenching of the inside at that time would have no useful effect. It is also necessary to dip the shells vertically.

It is debatable whether the shell should be immersed base first or nose first, but I believe that on account of the subsequent threading of the nose it is desirable that this part be quenched last with the view that it will probably be less hard by so doing. Another point against the practice of quenching in an open tank is that of the vapor arising and the actual burning in some instances of the oil, and its consequent loss, to say nothing of the discomfort to the operatives caused by the vapor coming off of the tank.

Finally it is well known and easily observable that when a shell or other hot piece of material is dropped in a tank of oil, a blanket of gas, steam and bubbles quickly forms all around the shell, and if the shell remains stationary this blanket of gas does not quickly leave the shell, but forms a very effective nonconductor around it which slows down considerably the cooling process.

The Quenching Arrangement

After considering all these questions I am equipping our plant with a quenching arrangement which although not yet in actual service appears certain to obviate practically all of the difficulties. The drawing shows this arrangement and represents exactly what I am installing in the plant of the Moon Motor Car Co. of St. Louis.

Referring to the drawing the manifold *A* is constantly filled with quenching oil at a pressure of say 15 or 20 lb. per square inch. As each shell comes from the furnace it is tipped up with a pair of tongs and slid down into the chamber as shown at *B*. The lid is closed and the cock communicating with the manifold immediately opened. This cock opens a 4-in.-diameter way for the passage of oil directly onto the base of the shell, and also through the tube *C* (which is 1¼ in. in diameter) directly to the inside of the shell. The opening between the shell and the housing which contains it is of such area that there is a restriction in the 4-in. flow of oil. The opening in the nose of the shell when inserted over the 1¼-in. tube is also of such a size that there shall be a similar restriction from the inside of the shell.

Flow of Oil

This construction insures that the housing containing the shell shall be immediately completely filled, and also that the inside of the shell itself will be simultaneously filled, and that there will be a rapid and vigorous flow of oil over the surface of both the inside and the outside of the shell, scrubbing away from these surfaces any gas or bubbles that must form when the oil comes in contact with the heated steel. The rapid flow of the cool oil continuously displaces the oil which has become hotter and insures the most rapid cooling of the shell both inside and out, thereby retaining as nearly as possible the structure obtained by the heating.

In addition to this it will be clear that all gases formed by the heat have no means of egress except to pass away through the downward opening into the 12-in. manifold *D* and back to the auxiliary oil supply, condensing on their way and thereby preventing the waste of oil. After this flow of oil has been permitted for a predetermined time the 4-in. cock is turned off and the shell allowed to remain in its position nose downward for a minute or two, so that it may thoroughly drain. The cover is then opened, the shell withdrawn with a pair of tongs and placed in the redraw furnace.

Extracts From Chordal's Letters

ALMOST unbelievable as have been the mechanical feats performed by gun makers in this greatest of all wars Chordal refers in this contribution to the evolving of a big gun (big for that day) called the "Long Cecil." This piece of ordnance was used in the Boer War, and an account of it was published in the American Machinist about twenty years ago. Tragically enough George Labram, the inventor, a most resourceful and accomplished man, who had charge of a machine shop in South Africa, was killed before the gun had reached its aim, but he left behind him a great work of emergency engineering and another proof that in this branch of science there are no such words as "It can't be done." Our correspondent also refers to Yeomens' big concrete planer.

Mr. Editor:

We are having great times nowadays doing apparently impossible things, such, for instance, as creating some ordnance establishment in eight months which, considered in its construction of plant, in its equipment, in its organization of staff, in its productive personnel and its quantity and accuracy of production, would, under usual circumstances, represent several generations or many years of the building up of an industrial establishment. It would have been very much easier to dispose of this entire proposition by simply letting it alone, and saying, "It can't be done."

* * * Here is something worth pasting in your hat or sticking on one face of one of the shop columns:

> The wise and active conquer difficulties
> By daring to attempt them,
> While sloth and folly shiver and shrink at sight
> of toil and hazard
> And make the impossibility they fear.

This, I believe, was written by Mr. Rowe; but here's another one you can paste in your hat lining or stick on another face of the shop column:

> War hath her victories no less renowned than peace.

I believe this was not written by Mr. Milton.

* * * If your shop were thousands of miles away from supplies and were completely surrounded by the enemy, and if the enemy with its powerful guns were dropping shells around the shop, and if all the shop men were out in the rifle pits, and if you had no gun that could reach the enemy, then it would seem as though you had some incentive to action.

* * * But there are two kinds of men in the world, and both probably of equal wisdom, such as the one who would say that now was not the time to even think about doing some certain desirable thing, and the other who would say that of all times in the world now is the time to do it, and who will proceed instanter to see if it looks as though it could be done. It is the old story of "when you want a pistol you want it."

* * * And this very business really happened about twenty years ago, and if you care to do so you can read pretty fully about it in some *American Machinist* printed about 1900; but the circumstances of the world today are such that this good old story becomes well worth bringing to mind.

* * * The town was Kimberley in South Africa; the shop was the construction and repair shop of the De Beers diamond mine, and the man was George Labram, the chief engineer of the company. From the shop point of view Labram was glorious.

* * * Labram's thought of the possibility of making a gun powerful enough to reach the enemy was an inspiration. His figuring on the reasonableness of the proposition was a cool piece of emergency-engineering thought; his convincing data and argument put before the officials were an initial triumph; the actual making of the gun and its actual delivery of shells into the positions of the distant enemy were a final triumph of shop coöperation. Before this gun had ceased its work George Labram was killed.

* * * This gun, which was christened the "Long Cecil," went into professional song and story; the British government had nice little models of it made and distributed them among nations. You can find one of these models within a few minutes' walk of where you read this letter if you only know where to look for it, providing you read the letter in New York.

* * * We can well imagine Labram, after his project had occurred to him, looking around the shop to see what was available. There could be no thought of sending off to England for needed material for the twofold reason that it was a long, long way to England, and the enemy might object anyhow. Furthermore, if things were to be got from England, why not have them send a gun—they certainly had plenty of them.

* * * Labram found a steel billet in the stock pile. It figured out as being big enough for the tube of the gun, and he found some heavy, flat bar iron that could be welded up into the hoops. The remainder of the stuff needed was clearly within the immediate capacity of the shop. There was no lathe long enough to serve as a boring machine or as a rifling machine, though there were a number of lathes large enough and long enough to do all the ordinary lathe work on the job; but the shop was familiar with the old expedient of taking two similar lathes and placing them end to end, one of them being stripped. Here was the possibility of the long machine.

* * * With such data and schedules the officials were appealed to. There were struggles and arguments and, eventually, assent, and instantly the work began in the shop, workmen being called in from the rifle pits. The drawings had not been made, but that billet had to be bored anyhow, and the work on the tube would furnish time for doing other things.

* * * The few available books on ordnance were

studied; the lead pencil worked hard making calculations as to probable strains and probable strengths; details were designed; methods of procedure were worked out; tools were contrived. The gun was to have a caliber of 4 inches.

* * * Some men, giving consideration to the hurry of things and to the emergency of the proposition, might look at a picture showing such a gun as they thought they would build, and say, "Now, we can leave off this and we can leave off that in order to save time and labor," but the makers of this "Long Cecil" decided to leave off nothing from the gun or its carriage; that the tube in its production alone and in its immediate assembly would be the thing in hand for the greatest length of time, and that during this time everything else could be done and done right. There seems to have been one exception in the scheme of not leaving anything off, as will be later explained.

* * * To center the billet and turn it to shape, and to chuck it and carry it in a steadyrest and to drill a hole through it and then enlarge the hole and to have the hoops bored and ready, and to turn the tube nicely for the shrinking fits, and to shrink the hoops on, would not strike one as out of the ordinary if done in the piping times of peace. But the enemy's shell dropping around the shop might form a special incentive to progress or it might form a special incentive to knock off work.

* * * But when it came to the rifling we do not understand that anyone on the job had ever seen any such work done, nor are we told that they got their rifling apparatus anywhere except out of their own heads. The one they rigged up seems to have done the work all right and not to have been a bad arrangement even when conceived in the light of modern ordnance operations.

* * * The rifling in a gun is, in effect, a multiple-threaded nut, but the pitch is so coarse that the lathe, or two lathes rather, of our Kimberley friends became a planer, the gun remaining stationary while the carriage of one of the lathes reciprocated the rifling bar in taking one cut after another to produce the groove, and in producing the 32 grooves one after another to complete the job. And this screw, with its many threads, was not of the same twist all the way through the gun, the increasing twist plan having been determined upon. We are not told much about the rate of increase in the twist, but it may be well to know that at about that time our own 3-in. field guns started their rifling with a turn in 150 in., increasing in twist to a turn in 75 in. during a travel of about five feet, the twist then being uniform to the muzzle. This cutting of the grooves in the bore would be quite apt, of course, to produce fins at the margins of the lands of the rifling and we would not have been surprised if these gentlemen had let these fins go, probably to be cleaned up by the first shot out of the gun. But they did nothing of the kind. They lapped the rifled bore.

* * * Where originated that "Song of the Screw" in which the question of twist is rather fully analyzed in verse, a couple of lines as I remember being:

> Zero pitch is pure rotation,
> While infinite pitch is pure translation.

* * * Our Kimberley friends now bored the breech chamber and threaded it for the breech block which was to screw freely into it. And here is where we find that something was left off. To screw the breech block in place would require about ten turns of the block, but in established ordnance construction on the interrupted-screw principle longitudinal grooves, generally four in number, are cut on the block and in the gun, thus producing a mutilated screw which would permit the block to be poked straight in, nearly home, and then brought entirely and forcibly home by a trifle of turning movement. Instead of mutilating the screw the constructors left it intact on the theory that while time might be lost in opening and closing the breech of the gun more valuable time could be saved in the shop. If this shop time had been needed on the breech block only it need not have been considered, but serious thought had to be given to holding back the gun long enough to put the grooves in its breech threads.

* * * Everything was made for the gun and its carriage, except the wheels, for it was found that an old traction engine would furnish just the steel wheels needed for the carriage after being bored and bushed. The gun fired its first shell, out of 225 shell, 24 days after the order was given to start on. The ammunition was home made, but this does not seem to have worried the De Beers shop much for the shop had already been making shell for smaller guns in use by the garrison.

* * * Whatever may have been the influence of "Long Cecil" in relieving Kimberley of her sore strait, and whatever may have been the deficiencies of the gun as measured by ordnance standards we of the shop are bound to take off our hats to the men who dared it and to the men who did it. It was one of the victories of war.

* * * There is a long time elapsing between the time of the "Long Cecil" and today, and it is a far cry from Kimberley to Chicago. But if you happen to want some big planing done in Chicago you might have to wait months for some busy big planer to find the time to do your job, and a much shorter process would be to buy the planer. But big planers, old or new, seem to be as scarce as hen's teeth, and appear to be made out of the precious metals. But war calls for big guns, and big guns call for big lathes, and the making of these lathes calls for big planers, but neither big planers nor big planing is to be had in time, but here we find Mr. Yeomans turning up. It might be as hard to get a big planer into Chicago as it was to get a big gun into Kimberley, but Mr. Yeomans starts in on the job and builds the big planer of concrete mainly, and has the first one running two months after starting on the job of making concrete structures outdoors in freezing weather.

* * * A description of these planers has been published, but care seems to have been taken in the description I have seen not to tell us how big they are. It's a military secret, I suppose; for while we are given the length of the bed and its width and the marvelous dates, we are not told how wide the machine will plane nor how long it will plane, though we can reason out from the published drawings that the planers will take in about ten feet between the housings and plane something over one hundred feet in length.

* * * Hogrebe, over at the crane shop, thought of getting a new automobile, and he showed me one of the beautiful catalogs he was studying over, and called my

attention to the fact that there were very complete statements as to the thickness of the upholstering, but no mention of the diameter or number of cylinders.

* * * Whether or not "Long Cecil" has furnished anything of originality in gun construction, Mr. Yeomans' concrete planers certainly have not only furnished another example of the victories of war, but have furnished a scheme of originality well worth thinking over for all time. I hope some day to be able to see one of these planers.

Very respectfully,

CHORDAL.

Draftsman or Engineer

BY G. J. WHITE

That there is a scarcity of designing draftsmen at the present time is obvious. The author of this article points out what he believes to be the psychological reasons and how the condition may be remedied for the future.

AMONG the many unforeseen problems that the war has brought about there is one of far-reaching importance to the country's industrial life which has not yet received the public attention that it deserves and that if not properly attended to is bound to cause embarrassment to our country and people. It is the scarcity of draftsmen, which, as far as memory goes, never before existed in this country.

In any daily paper or technical magazine may be found a number of advertisements by manufacturers, engineers, contractors, municipalities, states and even the federal Government holding out good salaries, steady positions, advancements and promotions for mechanical, structural, electrical and other draftsmen.

Anybody acquainted with industrial conditions in this country, and knowing that the smallest machine part requires the work of some draftsmen before its manufacture can be begun, will at once realize what this scarcity means to a country at war. Without making any attempt to investigate the cause some panic-stricken people started to find remedies, among which were night courses for draftsmen, inviting women to attend such courses, and other attempts of a palliative character that at best could only produce half-baked draftsmen.

THE REAL QUESTION

In order to approach a solution of a problem it is first of all necessary to put the question in the right way, and a question properly asked is already half answered. First of all, is this a purely American question or does it also exist in other highly industrialized countries, such as France, Italy, Switzerland and other European countries?

All those acquainted with industrial conditions in these countries will admit that a draftsman problem does not exist in them for the reason that the draftsman as a type or a class does not exist there. This sounds surprising and at once calls for a definition of the word "draftsman" as it is used in American industry. This is the most difficult part of the whole problem, and after one lets the different kinds of draftsmen pass before his mind the word seems offhand undefinable. The man who draws up lettering for door signs is a draftsman, the man who traces a map is a draftsman, the man who figures the stresses in a bridge is a draftsman, the man who designs the foundation for a 70,000-kw. turbine is a draftsman, the man who schemes out a complicated synchronizing diagram is a draftsman, the man who designs the control apparatus or the mast for Uncle Sam's battleships is a draftsman, and so on. This conglomeration of men and trades is put in a drafting room and given the group name of "draftsmen."

In European countries, be they as highly organized as Sweden or Switzerland or as disorganized as Russia or Spain, such a conglomeration does not exist. There is a well-recognized distinction between the man who does responsible designing work requiring a college education and the man who does detailing from a design, or only tracing, the former having the title engineer and the latter draftsman. In those countries the title of "engineer" gives its owner well-deserved social and even political recognition.

Coming back to the United States and analyzing the advertisements for draftsmen it will be found that although officially there is no distinction between the "designing draftsman" and the "drawing draftsman" the scarcity exists only among designing draftsman and that there is an ample supply of detailers, map makers, tracers, etc. On the other hand the discovery may be made that although a great percentage of college graduates have flocked or have been drafted into the Army there seems to be no scarcity of office engineers. This seems strange and proves that those men who went into the Army were either doing work of no importance before the war and therefore could easily be spared in their industries or that the war has changed conditions to such an extent that their services could be easily dispensed with.

A SPECIFIC CASE

The case of a certain operating company may throw light on this subject. Nearly all the members of the engineering staff of that organization were either drafted or enlisted in the army, and when the general manager was asked how he got along without them he replied that it so happened that most of his good draftsmen were not accepted for service and that he is carrying on the business with them. He remarked that they were all that he needed and that the company was doing as much business now as before the war. This and other instances show conclusively that it is the designing draftsman who carries the burden of American industry.

The designing draftsman should be a college graduate for two reasons. First, because he must have a great deal of theoretical and laboratory knowledge, and second because he must be trained to think independently, must be agressive, sure of himself and willing to develop and

take the responsibility for new ideas. Although these traits will often be found in nongraduates the college atmosphere will tend to promote them more than anything else.

It is such draftsmen that are scarce. And why? According to the law of supply and demand it should have been expected four years ago that college graduates would flock into the drafting rooms, where good salaries were offered to them, and today there should be no scarcity. But the law of supply and demand of economics is nothing but the universally true second law of energy, which states that energy will act, or, in other words, any action that takes places will be from a point of higher to one of lower potential, provided the difference in potential is not compensated by an opposing difference in potential of the same or other energy.

The American graduate does not want to go into the drafting room, and since according to the law of supply and demand, or the second law of energy, he ought to there must be some other source of energy acting against it. This source of energy may at once be seen to be psychological.

Question of Titles

After working hard for several years to obtain his degree of "engineer," of which he is rightly very proud, the graduate objects to be placed in a drafting room where he is called draftsman, treated like a day laborer, and with no distinction between himself and a tracer. He feels when accepting a position as a draftsman as though his highly cherished degree of engineer is being taken away from him. Once a draftsman it will be difficult for him to be anything else for a long time because a draftsman will seldom be offered anything but a draftsman's job. After having attained to high skill and experience in his own line of designing he often must take orders from some office engineer who may never have had such experience and who by mere accident may have been taken into some office soon after leaving college, either through personal acquaintance or other reasons.

Competent Engineers

Placing incompetent engineers in positions of direct supervision of designs often leads to poor designs, unnecessary expenditures in material and labor and sometimes to danger to life and property. Poorly designed high-tension rooms in American power plants, which were the cause of many accidents and deaths, may in many cases be traced to the fact that the space requirements were determined by an incompetent engineer who never went into the detail of a design except for the drawing class at college. And invariably engineers of this kind will throw all their mistakes on the drafting room and take for themselves all the credit that is given for good designs.

Many cases are known where ideas developed by draftsmen were patented by engineers. The draftsman is often kept away from the rest of the world and even from the rest of his own profession. He is not called into conferences and discussions on questions of design, where, being best acquainted with all the details, he could make valuable suggestions. He is not permitted to come in touch with any correspondence between manufacturer, operator and station designer, and he has to obtain all his information in an indirect way, often through a series of incompetent engineers, which becomes cloudy by the time it reaches him. Thus the draftsman, unless gifted with a great deal of energy, will become dissatisfied and fall into a rut and lose interest in his work.

Socially his standing is not of the highest, being about that of a day worker's, and it may be said that there is not one draftsman in America able to do independent designing who does not consider it a misfortune to be a draftsman and would not much rather sit in an office chair at a lower salary.

Suggested Remedies

The reasons for the scarcity of high-class draftsman are therefore, first, that a college education is necessary and, second, that the American college graduate does not want to go into the drafting room. The following is suggested as a remedy:

1. The designing draftsman should not be called draftsman, but engineer, and should be recognized as such professionally and socially.

2. No one should have charge of designing work unless he has spent a certain length of time in a drafting room; otherwise he will arouse jealousy in the designing draftsman, upon whom he will shift responsibility, not being able to take it himself.

3. The drawing board should not be permitted to become the dead end of a good man's ambition. The designing draftsman should be given an opportunity at correspondence, testing, inspection and construction, which would tend to make him more interested and more efficient in his work. When a place is open in the office it should be filled from the drafting room instead of from the outside, and such a change should not be considered a promotion but a transfer.

Some up-to-date engineering firms have recognized the above as meriting a trial and have partly introduced the changes enumerated and they agree that the results are satisfactory and that if the method suggested above is followed no artificial means will be required for the training of designers.

Pattern and Tool Plant Wanted in Kentucky

Tampton Aubuchon, secretary and general manager of the Louisville Industrial Foundation, states that the Million-Dollar Factory Fund of Louisville, Ky., has appointed a special committee composed of representatives of a number of large manufacturing concerns to negotiate with manufacturers of tools, dies, wood and metal patterns, with a view to establishing a tool and pattern plant to be located in the Louisville industrial district.

The need of a local high-class pattern and tool shop is accentuated by the unprecedented growth of 59 metal-working plants in the Louisville industrial district during the past few years.

The committee has begun negotiations with a number of large tool and pattern concerns, and it is believed that the necessary arrangements for the establishment of such a plant in Louisville will be consummated at an early date.

An Emergency Labor Reserve

By PROF. C. W. PARK
University of Cincinnati, Cincinnati, Ohio

ONE of the most serious labor problems just now arises from a shortage of unskilled workmen of the floating, or irregular type, that could formerly be obtained on short notice for seasonal or emergency work.

For several reasons this kind of labor has become increasingly scarce since the beginning of the war. In the first place employment managers have wisely cut down the turnover of unskilled as well as of skilled labor, greatly reducing a certain class of industrial tourists. Deferred classification under the draft has protected skilled as against unskilled workmen. The work-or-fight rule has forced many occasional workers into steady employment, so that the old-fashioned happy-go-lucky citizen who "helped out in a pinch" and loafed between times has become virtually extinct. All these influences undoubtedly represent sound labor policy, since they have stabilized industry, increased production and protected the key men. At the same time, owing to the rapidity with which these measures have gone into effect, the old elasticity in the supply of unskilled labor has disappeared, sometimes before adequate readjustments could be made.

Seasonal Work

It is true that some forms of seasonal work, such as harvesting and fruit gathering, have been well provided for by the United States Bureau of Labor, notwithstanding the heavy drain by enlistment and war work upon the sources of unskilled labor usually depended upon for these tasks. There are many forms of occasional work, however, the variations of which cannot be anticipated and which must be handled by a more or less elastic local supply of unskilled labor. The latter class of jobs, although not so noticeably important at any given time or place, extends over the entire year and affect many phases of production. Even in normal times it is not always easy to provide men for these occasional tasks, but at the present it is almost impossible. A striking example of such work is that of unloading coal cars, much of which must be done by hand. Shipments are necessarily uncertain, and when the cars arrive it is difficult to find men to unload them promptly. The fact that demurrage is paid on the cars thus held affords small satisfaction. The important thing is to keep the rolling stock in motion, since the coal problem is one of transportation more than of mining. In this respect the cumulative effect of small delays spread over the country and throughout the year means an enormous loss to industry. If to this is added the waste and financial loss from similar causes in other lines it will be seen that there is an industrial need that the country can ill afford to ignore.

Since the tasks requiring unskilled labor for brief periods and on short notice are widely scattered and are relatively small in themselves it is not fair to expect a federal employment service, however ubiquitous and efficient, to look after them except in a general or supervisory way. The problem is primarily a local one, and its solution must be local. In order to deal promptly with the situations as they arise it is proposed to form in each community an emergency labor reserve. It is obvious that in the present state of industry the pooling or diverting of regular employees for this purpose is out of the question, since this would only cripple one kind of work for the sake of another. The members of the reserve therefore will be business and professional men whose contribution will be a net gain to production. Any man will be eligible to membership who is willing to give not less than four hours a week to essential unskilled labor. The work will thus be a sort of overtime on the part of busy men, but being a complete change from their usual duties it will have in it some elements of recreation. Depending upon the character of the work and the convenience of the workers the time may be put in on Saturday afternoon, one or two evenings during the week or perhaps in some cases a part of Sunday. Arrangements will be made to deal promptly with emergency jobs, and if necessary some of the work will be done by artificial light.

Details of organization will vary somewhat with the locality and the personnel of the workers, but for the sake of illustration the following arrangement is suggested: The men are divided into squads of six or eight. Through a local clearing house, or labor exchange, the leader of each squad negotiates with employers in need of extra help and notifies the other members as to the time, place and nature of the work to be done. The leader's part is largely managerial, and he may be a man not physically capable of doing hard work, but patriotically willing to do what he can. The remuneration to the squad would be the same as would ordinarily be paid for equivalent service, but much of it would preferably be put in the form of a contribution to charity or one some other basis that would favorably affect the spirit of the workers.

Emergency Tasks

Many kinds of work could be cited, but assume that the task assigned a squad is to unload a car of coal. This is an extreme example, since it is one of the most difficult of emergency tasks, and judged by our conventional prewar standards it may seem a grotesquely incongruous occupation for a professional man to engage in even temporarily. It happens, however, to be one of the most clearly essential and urgent tasks at present. The difficulty is not in reality so great as to frighten a prospective reservist. Since the work is done by the job and is divided among a number of men the part taken by any individual member need not be excessively burdensome. Moreover, the spirit of the undertaking and the motive behind it will serve to lighten the labor.

By agreement among the members, let us say, the money earned goes to the Red Cross, the French Orphans, the Belgian Relief or perhaps to a war-chest fund including these and other equally worthy charities. In addition to the fun of the experience the members of the squad upon completing their work have gained several highly desirable ends. They have increased the country's coal supply by releasing a car for immediate

return to the mine. They have saved their employer, or indirectly the consumer, the increased cost of demurrage charges. They have made a contribution to charity that is far more significant and satisfying than a mere money appropriation from their usual sources of income. They have had the benefit of some good physical exercise, as wholesome as it is strenuous—an excellent substitute for golf or bowling. Nor need they apologize for the circumstances. The signs of toil are soon removed with soap and water, and the wearing of overalls for half a day surely involves no permanent loss of dignity. Most important of all they have helped to fill an embarrassing gap in industry and have thereby justified the name Emergency Labor Reserve.

Many opportunities for performing such occasional tasks will readily suggest themselves. In every community and at all seasons there are likely to be emergency jobs that may properly be classed as essential and will therefore require the services of the "four-hour men," as the reservists may be called. An organization that is prepared to meet the varying local demands for such labor can play a very important part in winning the war.

Saving Tin in Railroad Antifriction and Bell Metals*

BY H. M. WARING
Engineer of Tests, Pennsylvania Railroad Co.

The necessity for conserving tin has recently been very forcefully brought to the attention of all consumers, and efforts are now being made to reduce the tin content in certain alloys or to substitute other alloys not containing tin.

The approximate composition of the nonferrous alloys in general use on the Pennsylvania Railroad are as follows:

	Copper	Tin	Lead	Phosphorus	Antimony	Zinc
Phosphor bronze, specification 32-C	79.70	10.00	9.50	0.80	.....	....
Extra bearing bronze, specification 141	76.75	8.00	15.00	0.25	.....	....
Car-journal bronze (a)	(b)	(c)	(d) +	(e)	.....	(f)
Special high-lead bronze, specification 59	70.00	5.00	25.00	....	.....	....
Lining metal, specification 57	.....	.....	87.00	.....	13.00	....
Dandelion metal	.....	10.00	72.00	.....	18.00	....
Bell metal	83½	16½	.....	.....	.....	....
Babbitt, tin base	3.70	88.90	.....	.....	7.40	....
Babbitt for motor bearings	1.00	50.00	38.50	....	10.50	....

(a) Sum of Cu, Pb, Sn and Zn, not less than 99.
(b) Sum of Cu, Pb, Sn and Zn, not less than 71.
(c) Sum of Cu, Pb, Sn and Zn, not less than 4.
(d) Sum of Cu, Pb, Sn and Zn, not less than 13.
(e) Sum of Cu, Pb, Sn and Zn, not more than 20.
(f) Sum of Cu, Pb, Sn and Zn, not more than 3.

Phosphor bronze is used principally for rod bushings, main-rod brasses, and crosshead shoes.

Extra bearing bronze is used to a small extent for backs of car and coach bearings, but most of these are now made of the car-journal bronze, which contains on the average about 5 per cent. tin.

Car-journal bronze is used for making car and coach bearing backs at the Altoona brass foundry by melting down old backs after removing the linings and making the necessary addition of new metal to bring the composition within the limits given above. No new tin is added in making this alloy.

Special high-lead bronze is used principally for locomotive driving-box shells, which are not lined. The lead-base lining for car-journal bearings was formerly made up in our foundry from lining metal melted off from old bearings and brought up to specification requirements by the addition of such new metals as might be necessary. Some tin was unavoidably introduced from the old bearings, but the amount allowed in the metal was limited to 2 per cent. Lately we have been using this old lining metal in the preparation of the lead-base dandelion-metal babbitt, thus making use of the contained tin in order to reduce the amount of new tin which it was necessary to add to this metal. The journal-lining metal is then made from lead and antimony without the addition of any tin.

Lead-base dandelion-metal babbitt, containing about 10 per cent. tin, is used for lining crosshead shoes and also for lining engine, truck and trailer bearings, as well as for hub liners, in place of phosphor bronze on freight locomotives. This metal has replaced a large amount of tin and tin-base babbitt formerly used.

Tin-base babbitt metal (88.9 tin, 3.7 copper, 7.4 antimony) is used for a number of purposes in the shops, but its use has been greatly restricted, and every effort is being made to do away with it where possible, and to substitute a lead-base babbitt or a babbitt with 50 per cent. tin.

The amount of solder having the composition 50 lead, 50 tin, used by the Pennsylvania Lines East during 1917, was approximately 100,000 lb., but there is reason to believe that a large portion of this can be replaced by a 60-lead, 40-tin solder with satisfactory results, and instructions have been issued to this effect.

No change has been made in the specifications for bearing metals for some years, as the metals used have been satisfactory. A large proportion of the bearing metals are made up from old material remelted and brought to standard composition by some addition of new metal, and every effort is being made to utilize old material to the best advantage and reduce the amount of new metal of all kinds purchased. For a number of years no tin has been used in the lining metal of either passenger or freight-car journal bearings except such small amounts as come in from remelting old linings. No change has been made in phosphor bronze used for rod bushings, as we should expect some trouble from bushings pounding out of shape if a phosphor bronze were used which contained less tin or more lead than the present specifications call for. In this as well as in the case of all other bearing metals we expect to use our utmost endeavors to economize and to substitute for tin wherever possible.

*Extract from paper presented before the convention of the Institute of Metals, Milwaukee, Wis., Oct. 9, 1918.

Salvage of Munitions

At least one munition factory, it is said, has been permitted to salvage, by electroplating, low-velocity projectiles which have been machined slightly under the minimum outside limits. The bourrelets of these projectiles were carefully electroplated with nickel to bring them up the required 0.005 to 0.015 in. After plating they were again sent through the bourrelet-grinding machine and the plated surface reground to the exact diameter required. The *American Machinist* would be interested in receiving further detailed accounts of munition parts upon which this salvaging method has been permitted.

War Sparks from Industry's Forge

Edited by E.C.Porter

As a means of conserving metal for munitions the Government has requested that no metal goggle cases be furnished to the civilian trade. When ordering safety goggles it will be necessary for plants to give the Government order number on the work so as to be furnished with metal cases. When essential work is so diverse that no definite order number can be given, such as railroad transportation and maintenance, the general nature of the work should be stated. Failure to comply with this request will result in the supplying of cardboard boxes instead of metal cases.

* * *

A saw that can work under water saves $7 on each 1600 piles being driven in the ways extension at the G. M. Standifer steel yard, Vancouver. The piles are to be cut off under water and capped. The saw enables the piles to be cut and capped for 50c. each. The price on the same kind of work on the Columbia and Willamette rivers is $7.50 for each pile. A 48-in. saw is fixed at the end of a 12-ft. shaft and attached to a 25-hp. motor, with which it makes 250 r.p.m. under water. The whole is mounted on an overhead carriage running parallel with the cut. Two rails, one on either side of the ways, carry the rig down the ways.

* * *

Camp Joseph E. Johnston has begun to manufacture galvanized buckets for the Army. The Conservation and Reclamation Division at this camp has been converting old scrap galvanized iron collected about the camp, as waste or salvage, into serviceable buckets. The work has been done in the reclamation shops, and as it is proving profitable it will probably be extended. The Conservation and Reclamation Division of this Quartermaster camp has also been engaged in manufacturing serviceable and needed articles for the Army out of scraps. Nearly everything found in the camp is brought to the reclamation warehouse, and there seems to be nothing that ever reaches the division plant that cannot be made into something of value.

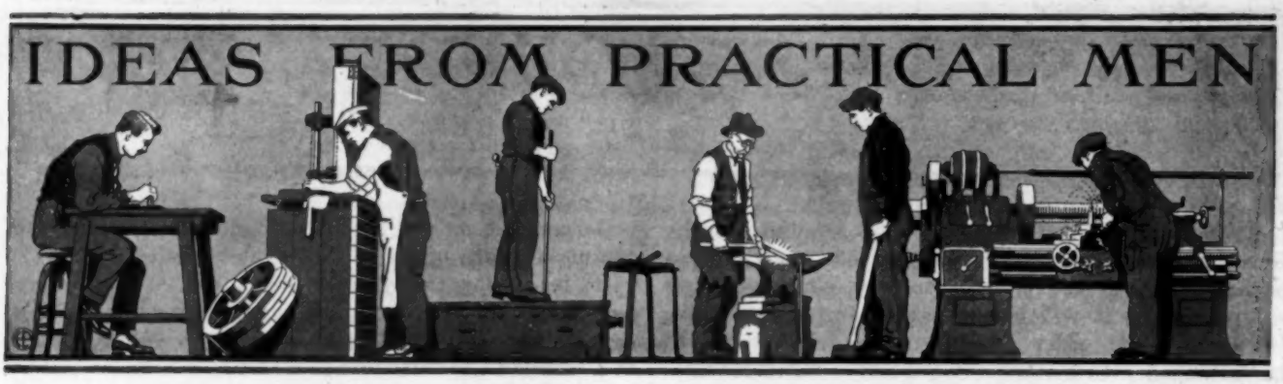
* * *

If all the printed forms shipped out by the Provost Marshal General's office since Aug. 7, 1918, in connection with the work of registration, classification and mobilization were placed in a pile 10 ft. square it would tower to a height of 887 ft., or more than one and one-half times the height of the Washington Monument. Altogether, since Aug. 7, there have been printed and shipped out 224,000,000 forms of all kinds, weighing 4,300,000 lb. and measuring in aggregate volume 88,787 cu.ft. Forty-four thousand mail sacks were used, the highest number shipped in a single day being 1828 and weighing approximately 83 tons. If these forms were placed in one mail train, 143 60-ft. postal cars would be required, and the train would be 1⅓ miles long. If the forms were placed end to end they would extend 68,044 miles.

German poison gas has been found harmless against gas masks worn by the United States troops in France. Field tests show that these masks afford 20 times more protection than German masks, and there is not a single case on record of an American soldier falling victim to a German gas attack when wearing the masks manufactured in the United States. This fact has been so thoroughly established by repeated experiences that military authorities place the blame for gas poisoning on the carelessness of the victim. Many American Army officers believe that in most cases the men who get gassed should be courtmartialed, not decorated. Every American soldier who goes to France is a gas-mask expert. He has been trained to adjust his "land life preserver" with almost incredible speed. The mask is put on with just five motions of the arm and hands. Although a gas mask is a very uncomfortable article to wear the first few times, the soldier soon becomes accustomed to this handicap on the natural way of breathing. It fits over the head like a baseball catcher's mask. A nose clip closes the nostrils and insures breathing through the mouth by a tube connected with a canister filled with chemicals. The exhaled breath leaves through a flutter valve near the chin. Air cannot reach the mouth except by passing through the chemicals in the canister, and exhaustive experiments show that these chemicals never fail to extract the poison.

* * *

Since 1910 and up to last August the highest number of locomotives ever turned out in a single year was 3776, which represents an average weekly output of 72.6. During last week the Baldwin Locomotive Works turned out 87 locomotives, seven gasoline and three electric locomotives, and made general repairs on 10 steam engines. The American Locomotive Works also obtained excellent results, and the Lima Works have developed to a marked degree in the last three months. In a certain week the output of the three standard-gage companies was 144 locomotives—this at the time of the influenza epidemic when labor at the plants was greatly disorganized. The three companies alluded to comprise the standard-gage steam-locomotive industry of the country. Redistribution of orders and concentration by each of the plants on special types of locomotives have made possible an intensity of effort unprecedented in the industry. By arrangements the construction of all standard-gage locomotives for use in France was assigned to the Baldwin Locomotive Works, and all orders for the United States Railroad Administration were divided between the American Locomotive Co. and the Lima Locomotive Works. The achievement attained is particularly noteworthy from the fact that in bringing about this tremendous jump in production it has been unnecessary to expend a dollar to increase plant facilities or to enlarge the existing works.



Converting a Common Lathe Into a Shell-Turning Lathe

By R. S. Myers

The rough-turning operation requires suitable brackets or supports upon the back of the lathe for the former plate *A*, Fig. 1, which determines the form of the shell to be machined. This former plate is clamped to these supporting brackets until its proper position has been established for producing a correctly turned shell, after which it is securely fastened by dowels and screws. Attached to the cross-slide is an extension carrying a stud and roller, as shown at *B*, which roller travels in the groove in the former plate, the cross-slide screw being disengaged to allow the slide to accommodate itself to the former plate. The bushing, or roller, is free to move on the stud and in the former-plate groove. A strong coil spring under the cross-slide is sometimes used in connection with a single former plate on finishing operations, in which case the spring must be strong enough to overbalance the tool pressure. Weights can be used instead of a spring if desired.

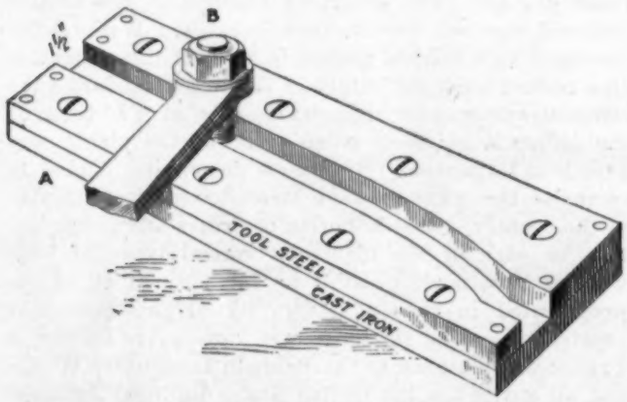


FIG. 1. ATTACHMENT FOR FORM-TURNING SHELLS

In Fig. 2 is shown the lathe spindle fitted with an expanding-jaw chuck. The draw rod is hardened on the end upon which the jaws bear. The jaws are of tool steel, and are retained in their proper positions by a wire-spring ring.

The parts described were designed for turning 4.7-in. shells on 21-in. LeBlond heavy-duty lathes, both the roughing and finishing cuts being accomplished by this method.

A Peculiar Shaped Worm

By Robert Mawson

A worm, in which the profile is convex instead of concave as in the usual form of Hindley worm, was recently made by the Presto Machine Works of Brooklyn as a gage to be used in the testing of racks in which special accuracy was required. The worm is shown in the cut, Fig. 1. All dimensions are in millimeters and the tolerance allowed was 0.01 mm.

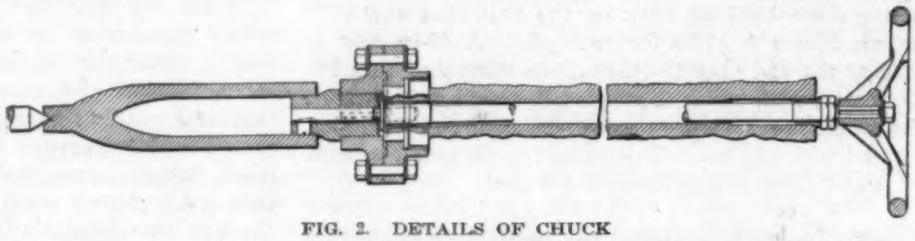


FIG. 2. DETAILS OF CHUCK

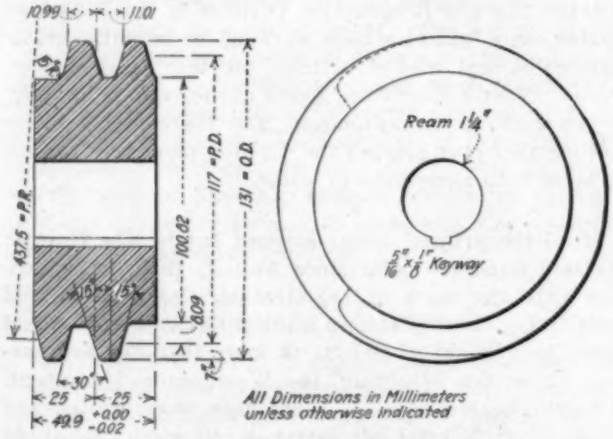


FIG. 1. SECTION OF WORM

To cut the well-known form of Hindley worm it is necessary to swing the tool in an arc the radius of which is equal to that of the driven wormwheel and whose center is located in the same relation to the worm being cut as the center of the wormwheel will bear to the finished worm when assembled. In the case under consideration the same conditions obtained except that

the center about which the tool was swung was located on the opposite side of the center line of the worm. The work was done on a 20-in. American lathe with the aid of the attachment which is here described. The tailstock of the lathe was lifted and the lathe carriage run to the right, leaving clear the shears between the lathe centers. A casting was made to fit over the shears with a bracket extending to the rear of the lathe. This casting was accurately fitted to the shears, being firmly fastened in postion with a flush-head bolt and a strap across the under side of the lathe bed. The extension to the rear carried a boss the center of which was located

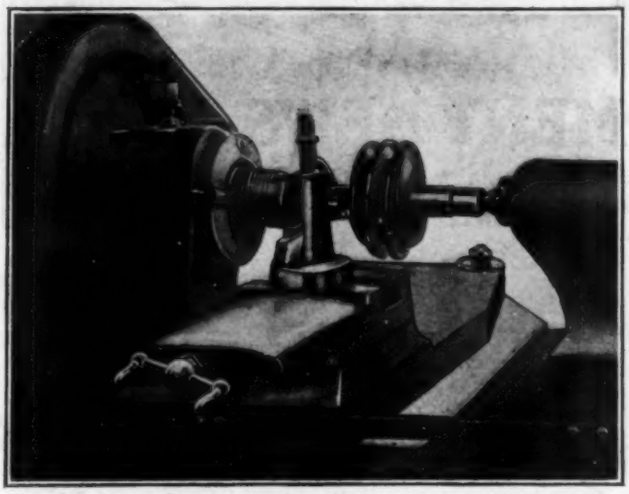


FIG. 2. LATHE SET UP FOR CUTTING THE WORM

back of the center line of the lathe a distance equal to 437.5 mm. less the pitch radius of the worm, which would bring the pitch line of the cutting tool to the required radius of contour.

To the top of this saddle was fitted a casting which was pivoted upon a stud set in the boss before mentioned and swinging in a horizontal plane about this stud as a center. To this second piece was fastened the compound slide of the lathe, thus providing a "carriage" which would traverse the tool in the arc of a circle and at the same time allow it to be adjusted for depth of cut.

The front end of the swinging member was finished to the arc of a circle the center of which was the stud upon which the member swung, the radius of this finished surface bearing the same proportion to the contour radius of the worm as the lead to which the lathe was geared bore to the lead of the worm. This latter was 22 mm.. and it was determined from the preliminary layout that the actual lead of the lathe (which was not calculated for metric pitches) should be 1.4 in., this amount lending itself most readily to the general proportions of the layout. The radius of the swinging member was thus calculated upon this basis.

The center about which the tool-carrying member swung was carefully adjusted to align with the center (lengthwise) of the worm when the latter was in position on the mandrel and the mandrel on the lathe centers. The lathe carriage, far enough in the rear of the tailstock to insure sufficient movement, was then locked to the lead screw in the usual manner and the lathe geared to cut 1.4-in. pitch.

Connection was established between the lathe carriage and the tool-carrying member of the special attachment by a flexible-steel band attached to the latter in such manner that the band would wrap around, or unwind from, the finished front surface of the casting as the carriage traveled back and forth.

As will be noticed from Fig. 1 the worm is left hand, thus during the cutting movement of the tool the connecting band would be under tension while the idle return movement was accomplished by attaching to the tool-carrying member a weighted cord.

With the lead of the lathe established at 1.4 in., the lead of the worm arbitrarily 22 mm., and the radius of contour required 437.5 mm., the mathematical calculation required to determine the exact radius of the front end of the tool-carrying member around which the flexible-steel band passes is reduced to a simple problem in proportion thus:

$$R : r :: l : p,$$

in which the three known factors are

r = Radius of desired contour of worm = 437.5 mm.;

l = Lead at which lathe is geared = 1.4 in., = 35.56 mm.;

p = Pitch of worm = 22 mm.

Substituting values the equation becomes:

$$x : 437.5 :: 35.56 : 22$$

or $\frac{437.5 \times 35.56}{22} = 707.16$ mm. $= 27.841$ in., the radius required. From this should be subtracted one-half the thickness of the flexible band.

In order to test the diameter of the worm a special device was necessary, as obviously the three wire systems would not give a correct reading. A bracket was fastened to the tailstock carrying a micrometer head directly over the center of the worm. By measuring first to the top of the thread and then turning the lathe exactly one-half of a revolution and measuring to a wire in the groove which would then be under the measuring spindle of the micrometer, the pitch diameter could be readily determined.

The set-up both for cutting the worm and the measuring device is shown in the cut, Fig. 2.

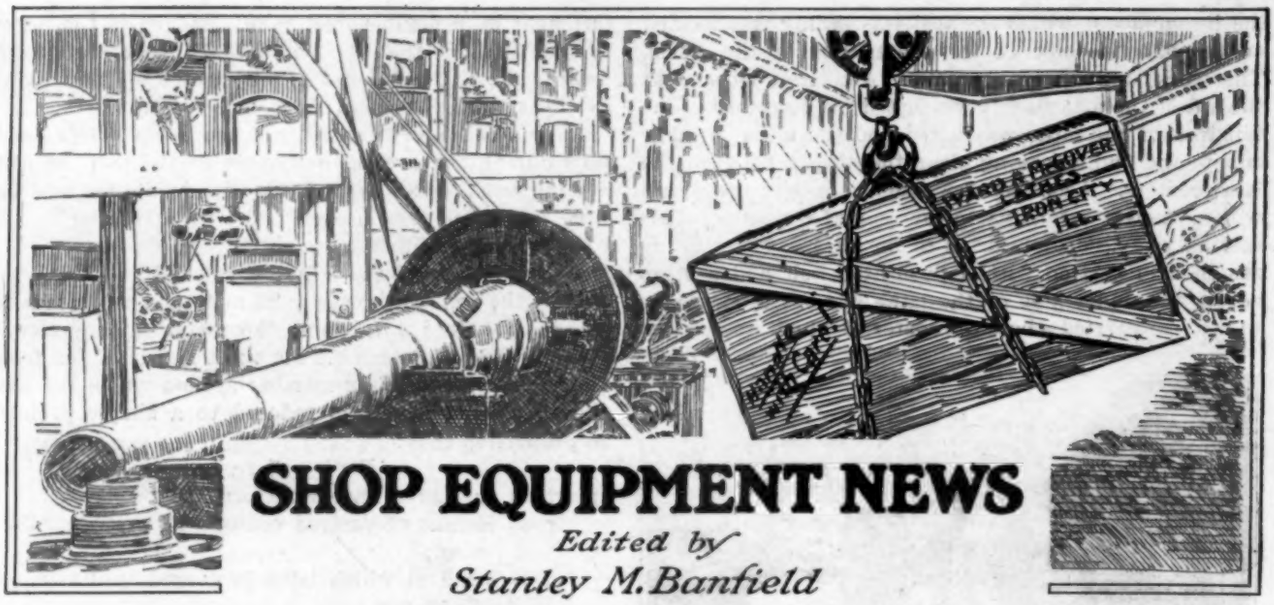
A New Valve Mechanism for Use on Airplane Motors

BY JAMES MARKOE

In an article by B. X. Reiter on page 600 of the *American Machinist* a valve motion is suggested for the Liberty motor to do away with side thrust of the rockers on the valve stems, but Mr. Reiter seems to entirely overlook the fact that the arrangement shown has this same defect. It is merely one-half a rocker, and the offending half at that. The arrangement he speaks of is quite old, being used in all the Sunbeam racing and aviation motors, also on several American cars, including the Chalmers of a few years ago.

He also speaks of it as not being adaptable to the multiple valves of the Liberty motor. I always understood that this motor used single valves.

Inclosing the entire mechanism while not necessary in the clean air in which an airplane operates, and disadvantageous in that it hinders the cooling of the valve stems and springs, is not fatal, however, as shown by the Hispano-Suiza.



SHOP EQUIPMENT NEWS

Edited by
Stanley M. Banfield

In conformity with a Post Office ruling, descriptions of new equipment can only be used in this department which have not been previously or simultaneously advertised in this or any other periodical.

"Bryant" Lathes for Turning Operations On 9.5-In. Shells

The R. M. Eddy Foundry Co., Chicago, Ill., is now marketing a line of lathes for 9.5-in. shells. These machines are made up for a variety of operations, the principal difference being that the carriage construction is made suitable for the particular operation for which it is desired to use the machine. The bed is of the flat-top box type with rigid drive supports cast integral, and is provided with a chip pan integral with the carriage. A small reservoir is also provided to catch the cutting compound, which has a suitable pipe connection for the return of the fluid to the main reservoir. The spindle is of semisteel and is hollow to receive the draw collet chuck. It runs in white-metal bearings and is lubricated by means of sight-feed oilers mounted on the top of the bearing caps. Thrust is taken at the rear, a nut and locknut providing means of adjustment for wear.

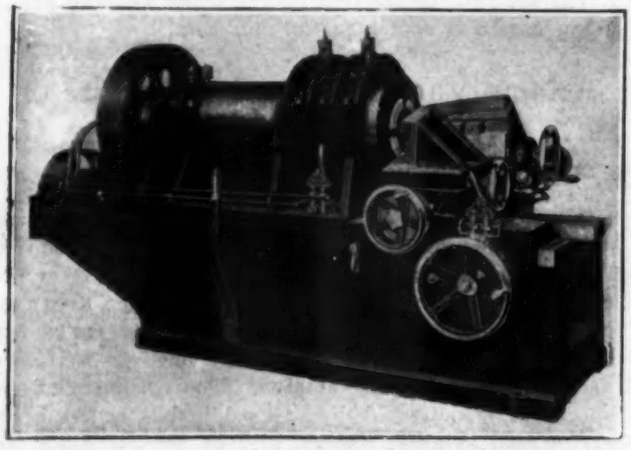


FIG. 1. "BRYANT" TYPE 9.5 REF SHELL LATHE

Swing over bed, 32 in.; front-spindle bearing, 16 x 16 in.; rear-spindle bearing, 8 x 10 in.; width of carriage guide, 9½ in.; area of carriage bearing, 397 sq.in.; length of carriage guide, 30 in.; driving clutch pulley, 18 x 6 in.; standard gearing ratios, 9.7, 8.8 and 7.3 to 1; pitch of gearing, 3; floor space, 3 x 10 ft.; approximate weight, 11,000 lb.

The chuck jaws are hardened and ground, engage a steel ring attached to the end of the spindle and are operated by a 12-in. air cylinder attached to the rear of the spindle and controlled by a conveniently located valve. The machine is designed to be driven by a 6-in. belt direct from the line shaft to an 18-in. friction clutch mounted on the drive shaft at the extreme end of the machine, and transmitting the power to the spindle through compound gearing. The drive gears are three pitch. The carriage of the particular machine shown in the illustration, which is the type 9.5 REF, for rough end facing the base end of projectiles, is provided with front and rear tool slides, both of which are operated by power feed, the rear slide being provided with an air cylinder for the purpose of withdrawing the rear slide to permit changing work. Both slides are regularly furnished with one specified feed per revolution of the spindle. Special carriages may be had to suit specific requirements. The standard equipment consists of gear guards, adjustable sight-feed oil cups and complete air equipment for operating the collet-type chuck.

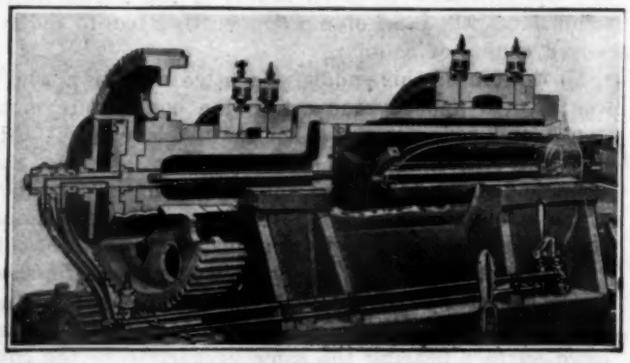
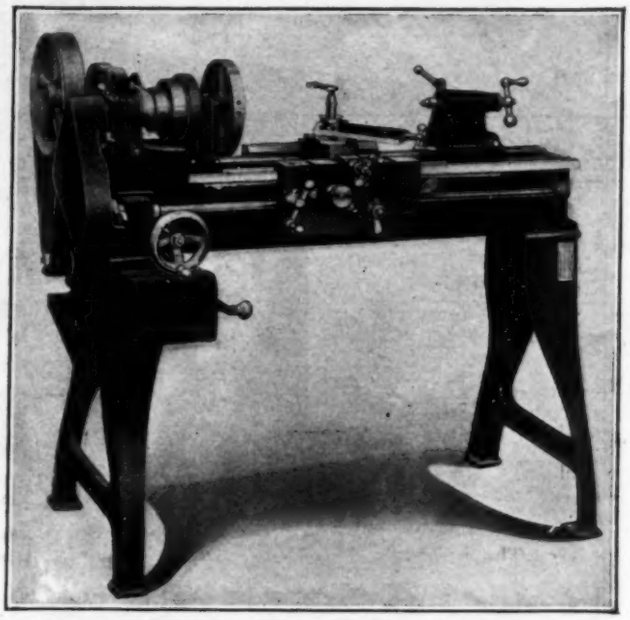


FIG. 2. A QUARTER-SECTION VIEW SHOWING THE SPINDLE AND CHUCK CONSTRUCTION

Sebastian 10-In. Motor-Driven Lathe

The 10-in. motor-driven lathe shown in the illustration is somewhat similar to that shown on page 593, except that it is equipped for motor instead of for countershaft drive. The headstock is provided with a three-step cone pulley for a 1¼-in. belt and back gears. A feed reverse for screw cutting is also incorporated, being operated by the handle at the end of the headstock. The spindle is ground to size and runs in phosphor-bronze boxes. The tail spindle is ground to size and is provided with an adjustable side movement



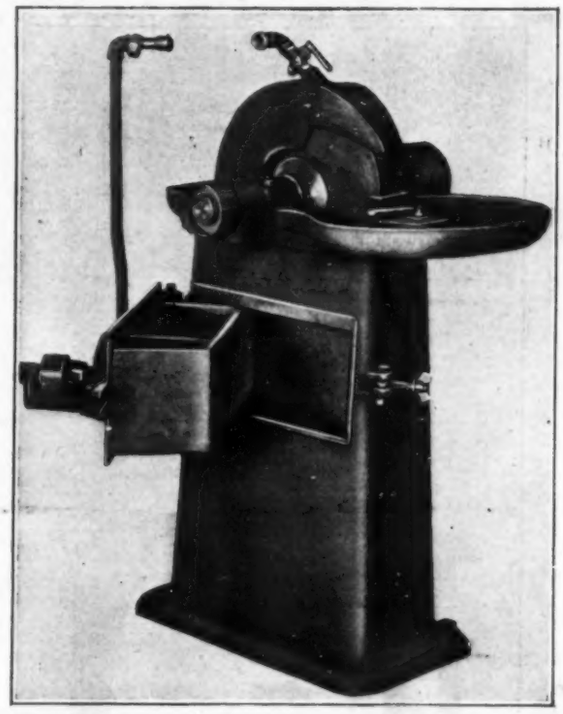
SEBASTIAN 10-IN. MOTOR-DRIVEN ENGINE LATHE

Swing over bed, 11 in.; swing over carriage, 7¾ in.; length of bed, 4, 5 or 6 ft.; front-spindle bearing, 1 7/16 x 2½ in.; hole through spindle, ¾ in.; three-step cone pulley for 1¼-in. belt with diameters of 5½, 4 and 2½ in.; distance between centers with 4-ft. bed, 28 in.; motor recommended, ½ hp., 1200 r.p.m.; weight without motor, 450 lb.; size of tools, ⅝ x ⅝ in.; travel of compound rests, 3¾ in.; capacity of center rest, 3 in.; centers, Morse taper No. 2; size of drive pulley, 12 x 2 in.; speed of drive pulley, 200 r.p.m.; spindle nose, 10 threads per inch; length of carriage on bed, 13⅜ in.

for taper turning. It is of the cut-under pattern to allow the compound rest to swing at right angles. The carriage has T-slots at both the front and rear and power crossfeed is incorporated. The regular equipment includes steady and follower rest, compound rest, 5 and 9 in. faceplates, wrenches and gears to cut all standard threads from 3 to 40. Extras such as plain tool block, taper attachment, tools for metal or wood turning, hand rest, raising blocks, special centers, milling attachment and chucks can be furnished if desired.

Valley City Wet Tool-Grinding Machine

The illustration shows the No. 16 wet tool-grinding machine now being made by the Valley City Machine Works, Grand Rapids, Mich. It is also made in a No. 17 style, with the spindle extended beyond the drive pulley at the right where a wheel for dry work is secured. The spindle is of crucible steel, ground to size, and runs in self-oiling dust-proof boxes. The water pan is hinged at the back of the column and can be easily swung out as shown by disconnecting the union at the top and throwing off the belt which drives the water pump. A plug is provided by which the tank can be drained and the tank and pump assembly can be entirely removed from the machine by withdrawing the hinge pin; the hood for covering the grinding wheel is hinged at the back and can also be removed by withdrawing the hinge pin. The water is distributed to the



VALLEY CITY WET TOOL-GRINDING MACHINE

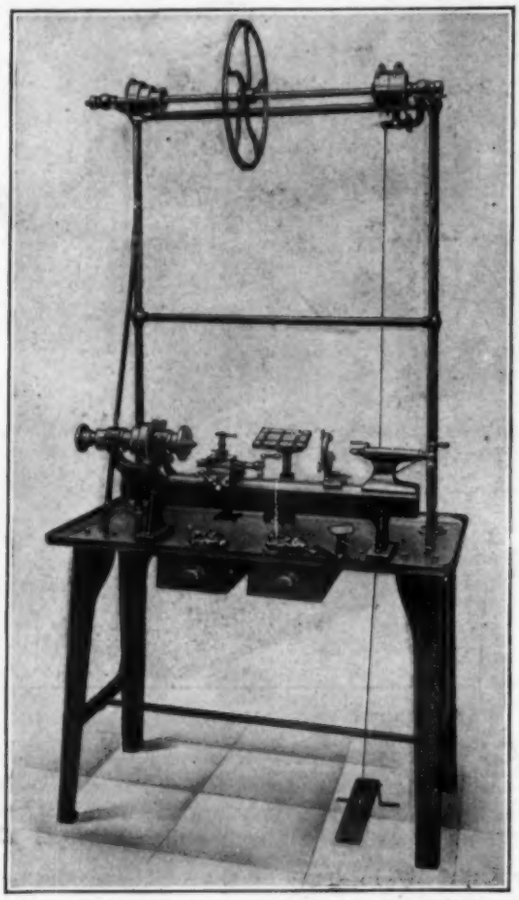
Size of wheel, 16 x 2 x 2¾ in.; length of spindle, 24 in.; spindle bearings, 1⅞ x 5½ in.; diameter of spindle between flanges, 2¾ in.; height from floor to center of spindle, 34½ in.; size of pulley, 6 x 4 in.; size of countershaft drive pulley, 12 x 4 in.; tight and loose pulleys on countershaft, 6 x 4 in.; speed of countershaft, 600 r.p.m.; speed of spindle, 1194 r.p.m.; floor space, 14 x 25 in.; shipping weight complete with countershaft, 600 lb.

wheel directly in front of the tool, and the quantity is regulated by a valve located just above the hood. The pan extends entirely around the wheel to catch the water, which drains back into the tank.

"Ideal" Precision Bench Lathe

The precision bench lathe shown in the illustration is one of the late products of the Precision Lathe and Grinder Co., a machine-tool branch of the Ideal Machine and Tool Co., 128-130 Opera Pl., Cincinnati, Ohio, and is known as the company's No. 3 machine. It is somewhat similar to the No. 1 and No. 2 machines manufactured by this company, except that the bed is a little longer. The spindle is ground and lapped, is threaded for a chuck or faceplate and is also fitted for draw-in collets to accommodate work of various sizes. The three-step cone pulley has 12 holes, equally spaced in a circle, for dividing work or for holding the spindle while tightening collets, while a brass collar covers the threads on the spindle nose, when these are not in use, to protect them from injury. Provision is made for taking up wear and end play. A table provided with T-slots and capable of being adjusted to any angle is mounted on a bracket at the rear. This is used for holding the work while performing various

surface-grinding operations or other such work. This universal grinding table is one of the features of the machine and is said to be very desirable when flat gage-grinding work is done. The machine is furnished either with or without hand-tool rests, centers, compound slides, center rests, internal and external grinding attachments, tight and loose pulley arrangements and



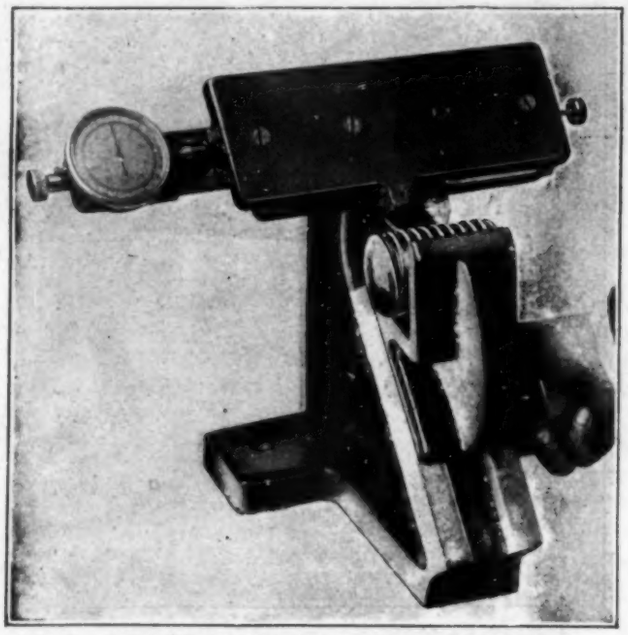
IDEAL NO. 3 PRECISION LATHE AND GRINDING MACHINE

Cone pulley, three-step for 1-in. flat belt; length of bed, 32 in.; distance between centers, 16 in.; swing, 7 in.; hole through largest collet, ⅝ in.; swing over compound slide rest, 2¼ in.; countershaft speed, 500 r.p.m.; net weight, 360 lb.; height of table from floor, 33 in.; size of oil-pan table, 24 x 44 in.

countershaft. The machine is mounted on a heavy steel oil-pan table measuring 24 x 44 in., which is fitted with cast-iron legs. The tables are fitted with two steel drawers for tools and collets.

Geometric Thread-Lead Testing Device

The Geometric Tool Co., New Haven, Conn., has recently placed on the market the thread-lead testing device shown in the illustration. The base has a small carriage fitted accurately to an inclined way, along which it may be moved by means of a rack-and-pinion mechanism operated through the knurled knob at the right. This carriage has a 50-deg. V on its upper surface in which the piece to be tested is placed. The head of the tool has a movable member mounted upon a ball bearing equipped with a means of adjustment so that its movement may be made as nearly frictionless as possible and yet all looseness removed. The movable member, or slide, bears against the measuring spindle of a dial indicator. Two measuring points are mounted in the center line of the carriage movement, one point being rigid while the other is attached to the slide. When in normal position the two measuring points stand one inch apart, the distance being adjustable by means of the knurled-head screw at the right. This acts upon a compensating spring opposing the spring of the dial indicator that may itself be adjusted to and from the slide by the knurled-head screw at the left. Measuring points are provided for the various forms of threads and are easily interchangeable. When pre-



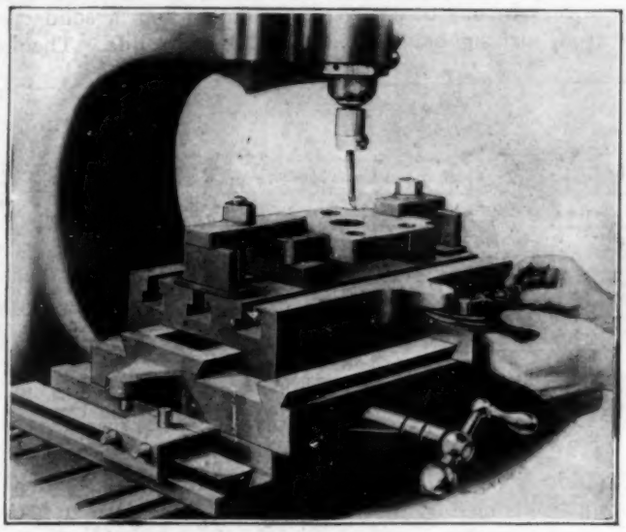
GEOMETRIC THREAD-LEAD TESTER

paring to test a screw a master plug containing two grooves of the shape of the thread to be measured and known to be one inch apart is placed on the carriage and run up to the points. While the plug is held in this position the screw at the left is turned until the pointer indicates zero. Then with the master plug removed the compensating screw at the right is turned so that the gage indicates about —0.010 or —0.020. When the carriage is returned with a thread to be tested, the amount that the screw is long or short will be shown by the position of the pointer above or below the zero reading of the dial indicator, which is a standard instrument except that it has been fitted with a special dial having two series of graduations. The inner circle reads thousandths of an inch and the outer one indicates hundredths of a millimeter in order to allow metric threads to be tested. All important bearing surfaces are hardened, ground and lapped. The machine occupies a space 8 x 8 in., is 10 in. high and weighs approximately 17 lb.

National "Locator"

The National Tool Engineering Co., Indianapolis, Ind., is now manufacturing the "Locator" shown in the illustration. The device has been designed for drilling and boring holes in accurate relation to one another without the loss of the time ordinarily consumed in these operations by the button method. It consists of

a double cross-slide combining base, saddle and table, both the table and saddle being fitted with ½-in. pins in the line of their travel. Directly below are slides also fitted with ½-in. pins, and when the table and saddle are moved and the movement measured across the pins with a micrometer or gage block the change of position can



NATIONAL "LOCATOR"

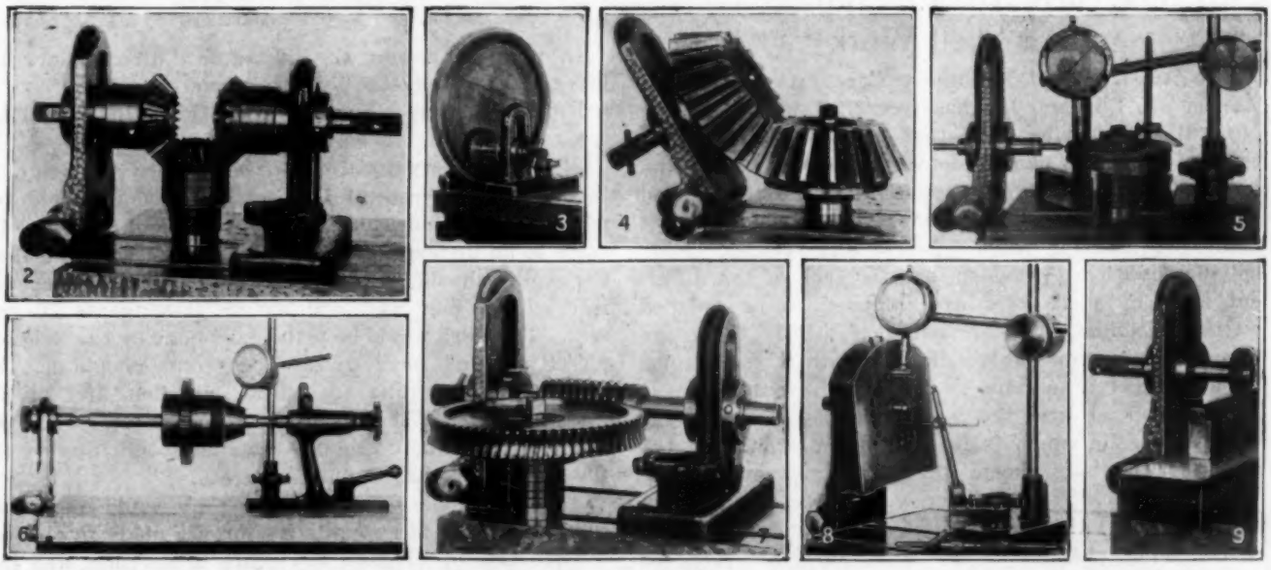
be easily adjusted to accurate limits. The machine is said to be very accurately constructed and is provided with means for securely clamping to the table of the machine on which it is used.

Eisler "C. E. Testall"

Charles Eisler, 36 Watsessing Ave., Bloomfield, N. J., is now placing on the market the "C. E. Testall" shown in the illustrations. Fig. 1 gives a general view of the machine, which was originally designed to meet a variety of requirements for testing and determining center distances of gears of all types, and for general center testing on a single machine where the variety of products handled is great and a single-purpose machine is therefore not desirable. The stand is at a

FIG. 1. THE EISLER "C. E. TESTALL"
Floor space, 22 x 16 in.; total height, 44 in.; size of table, 7½ x 17½ in.; weight, 160 lb.

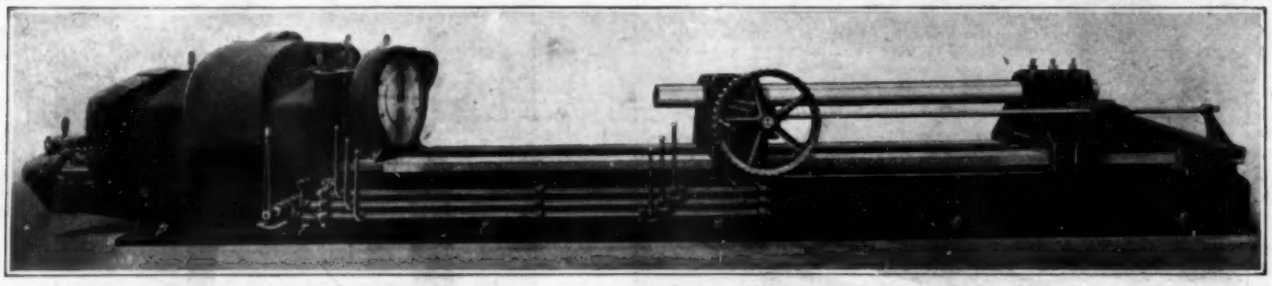
convenient height to insure comfort in handling the work, and a drawer is provided for holding parts not in use. The construction of the machine is such that it may also be used for a variety of other work, such as



FIGS. 2 TO 9. THE "C. E. TESTALL," SHOWING THE MANNER IN WHICH DIFFERENT JOBS ARE HANDLED

Fig. 2—A setup for testing reversing miter gearing. Fig. 3—Testing an internal gear and pinion. Fig. 4—Testing bevel gearing with axis angles of other than 90 deg. Fig. 5—Setup for testing cams of various forms. This method is also handy for laying out and checking work of this nature. Fig. 6—Testing work on centers. Fig. 7—Testing a worm and wheel. Adjustment for center distance and height may be quickly made. Fig. 8—Testing jigs or other tools, the machine being used as a laying-out table. Fig. 9—Testing a rack and pinion

cams, cutters, gages, reamers, hobs, jigs, etc. The wearing parts are made of tool steel, hardened and ground; the bed is scraped to insure accuracy. Two sizes are made, the smaller weighing about 160 lb. and having a table 7½ x 17½ in., while the No. 2 will handle work approximately twice the size. Figs. 2 to 9 show how some of the work that may be done on this machine is operated on. Fig. 2 shows a set of reversing miter gears being tested. It will be noticed that the bracket at the left is of the hinge type, being held in correct alignment by a pin at the extreme left. When the pin is removed the bracket may be swung down to the left and the gears quickly removed. Fig. 4 shows the testing of a pair of bevel gears. This shows more clearly the location of the pin mentioned in regard to Fig. 2, which is removed in this case. The bracket can be easily adjusted to suit the required angle. Fig. 5 shows the testing of cams, laying out and checking work being handled in a similar manner. Fig. 7 shows a worm and wormwheel being tested. Both the brackets are adjustable back and forward, and by this means any required center distance can be easily and quickly obtained. Fig. 8 shows the machine being used as a laying-out table in connection with a jig or die work. Fig. 9 shows a simple setup for testing a bracket pinion.



AMALGAMATED NO. 46E BORING LATHE FOR SHELL WORK

Floor space, 36 ft. 6 in. by 5 ft. 3 in.; height, 6 ft. 8 in.; main-drive pulley, 16-in. diameter, 12-in. face; pulley for rapid traverse nd reverse, 16-in. diameter, 6-in. face; spindle speeds, four, with gear ratios of 27.3, 31.3, 36.1 and 42 to 1; feeds, four, 0.070 to 5 in. per spindle revolution; diameter of boring bar, 7⅛ in.

Amalgamated No. 46E Boring Lathe For Shell Work

The Amalgamated Machinery Corporation, 72 West Adams St., Chicago, Ill., has recently brought out the No. 46E shell-boring lathe that is shown in the illustration. The bed and headstock are cast integral and an arm is bolted on for supporting the extended end of the pulley shaft, a secondary pulley and pulley shaft being provided for rapid traverse and reverse. Four spindle speeds are provided, one for each of the different sizes of shells that are intended to be handled on this machine, all gears being of steel. There are two drive gears on the spindle, the teeth of the pinions being staggered to improve the driving qualities. It is also claimed that the use of double gears on the spindle, one of which is located in the front and the other in the back, keeps the bearing from wearing bell mouthed. The lead screw extends through the center of the lathe bed and is supplied with a suitable drive. Four changes of speed are furnished, one for each size of shell, by means of gears located in the housing at the end of the headstock. A double-lever system for the various clutch controls has been provided and may be seen at the front of the machine. The levers at the tailstock end of the machine are mounted in a housing which may be moved lengthwise of the lathe so that the operator can change the position of these as desired. The rapid traverse is provided with a double clutch control and operates at about 6 ft. per minute. The boring-bar guide, or rest, is cast in one piece with a bolted-on top, a solid cast-iron bushing being used for the bar guide. The bar guide is moved along the machine by means of a half nut controlled by a lever on the side, the former fitting down over the lead screw when the latter is operated. The heavy carriage at the tail end of the machine feeds the bar and secures it against turning. The carriage is driven by the feed screw which passes through a long nut in the base of the carriage. Hand-operated feed is secured by means of a drive through miter gears and a worm and wormwheel. To take the thrust of the carriage the forward end has been extended beneath the ways and a gib provided on top, while at the rear the gib is beneath with the solid casting above, this construction serving to place the thrust on the solid casting instead of on the gib.

The Sales Question in Belgium

BY HENRI BENEDICTUS
London, England

In reply to Robert G. Pilkington's direct query in his article on page 366 of the *American Machinist* I will make a frank statement of what I think would be the correct thing to do.

Should the organization to be formed in Belgium involve a huge capital I honestly think it would be wise for the American capitalists or manufacturers to come to an understanding with a Belgian house so that the capital should be made up by both; say the American interests 80 per cent. and the Belgian agents 20 per cent. The work would be principally done by the Belgian merchants and their staff. The profits should not be distributed according to capital only, but first of all the active part of the organization should receive proper compensation and from the remainder the interest on the capital should be paid pro rata.

This would be a fair solution that would allow the greater part of the commercial profits made in the reconstruction of Belgium to remain in Belgium, and the only way to help the Belgian people to recover their lost capital. I hope I have made my idea plain, as I certainly believe that the majority of my compatriots will agree.

LATEST ADVICES FROM OUR WASHINGTON EDITOR

Washington, D. C., Nov. 9—As an indication of the way in which we are getting into our stride in the production of war material the recent announcement of the Chief of Ordnance that we are now obtaining approximately 500 each of 5-ton and 10-ton artillery tractors a month ought to be of interest. With gun production steadily increasing there is every reason to believe that our army will be equipped for the offensive in a way that has never before been known.

Another interesting change is the substitution of fabric for leather gun slings, which saves 15½c. on each sling, effecting a curtailment of over $190,000 in one contract of 1,250,000 fabric gun slings. Fabric is also being used in other places where leather was formerly called for, and there is likelihood that further substitutions will be made. It is not easy to make changes in specifications, but this is gradually being done, and the saving of leather should have its influence on goods of this material for civilian consumption from shoes to traveling bags.

There is a pronounced shortage of brass in this country due to unprecedented demand and to the shortage of labor and machinery for its production. Ordnance requires about 2,220 000 lb. of sheet brass and 840,000 lb. of rod brass a day; incidental requirements average 1,000,000 lb. of sheet and 300,000 lb. of rod a day in addition. Owing to all kinds of delays there is a daily shortage of about 1,500,000 lb.

Labor is being supplied to some extent by soldiers, 1000 men going from Camp Devens to the Naugatuck Valley mills to replace influenza victims, 20 to 40 per cent. of the employees of that concern being on the sick list.

Every effort is being made to eliminate brass in non-essentials and to use substitutes wherever possible. This has reached the point where General Goethals has ordered the abolishment of brass buttons on uniforms.

The machine-tool industry uses very little brass except in bearings, and not always there. And yet the total may count up more than is imagined. Cast iron makes an excellent bearing where it is well cared for and it can also be used as a backing for babbitt or soft metal lining even where it is not deemed advisable to use it as the bearing itself. Every little saving helps, and we should do all we can to attend to this the same as we do our Liberty bonds. Another matter of interest to machine builders as well as others is our rapidly growing merchant marine. If this is to serve us after the war is over, and it must, we have the machinery to operate it by. We are training the engineers and the seamen, but we are not preparing consuls to look after our interests at various ports. Not only is there need of more consular experts, but those we have will require a bit of training to be able to execute the work expeditiously, for, incredible as it may sound, some of our consuls, even in seaport towns, have never cleared a ship flying the American flag.

Previous to 1915 not a vessel flying our flag had touched at Queenstown, Ireland, in over nine years, and Queenstown is one of the greatest ports of call in the world. But this will be very different in the future, and we shall need consuls of the highest grade all over the world. First of all we must pay better salaries—they get less than ship riveters today—as they cannot maintain a family and their position on what they now receive. This is an emergency that is more worthy of the attention of Congress than some of its present activities.

Stick to the Job You've Got

By Edgar A. Guest

In the Detroit Free Press

"I'm goin' to quit," said Dan McGann, when the evening whistle blew,
"So here's my badge and here's my tools and here's my pay checks too."
"What's wrong?" the foreman asked of Dan, with a strange look on his face.
"Nothing at all," said Dan McGann, "but I've found another place.

"I'm goin' to work in another shop an' stand at another drill;
I've got a friend that has asked me down to work at the other mill.
I've no complaint at my treatment here, you've always used me fine,
An' the only reason I'm changin' jobs is to help out a friend of mine."

"Do you know what it means when you're changin' jobs?" said the foreman then to Dan,
"You are hurtin' the boys that fight in France an' helpin' the Hun, my man.
You are hinderin' two machines that ought to run at their fastest speed,
An' they'll both fall short for days an' days of makin' the shells we need.

"Would you like us to wire to the boys in France to stand for a day or two
For the shells they need while we find a man to work in the place of you?
We'll forget the money an' time, my boy, that makin' the change will cost,
But while you're movin' from place to place it's life that is bein' lost."

"I'll stick where I am," said Dan McGann, "I'll stay till the war is done;
It shall never be said that I stopped one shell on its way to the dirty Hun.
An' I'll print this sign for the boys to read—perhaps it will help a lot:
'To win the war in the quickest way just stick to the job you've got!' "

(Copyright, 1918, by Edgar A. Guest.)

We can take a leaf out of Great Britain's book in this respect. British consuls are well trained and have done much to make British commerce what it is today. And we must not forget that, in spite of four years of war at her doorstep, Great Britain has kept the seas open, has served her customers all over the world as well as possible and has helped us move over half our troops and their supplies to France. Her consular service has been enlarged and will play a large part in repairing the waste of war when peace comes. Let us not delay too long.

Rejected Motor Parts

An interesting development in the aircraft program, and one that should appeal to mechanics as being desirable, is the utilization of Liberty motor parts that do not meet the rigid requirements of aviation. By this plan the rejected parts, which some accounts place in the neighborhood of 30 per cent., are to be sorted according to the amount of variation from the desired standard. Those which fall within certain limits are selected and sent to an assembling plant to be put together for motors to be used in large tanks and in similar work. These motors probably will be run at a slower speed and also with lower compression than airplane motors, so that the same nicety of fit is not necessary. This is a good way to utilize a substantial proportion of rejected parts at various Liberty motor factories, and the originators of the idea should receive suitable recognition.

What the Government Is Doing

Among the activities of the United States Department of Labor is a fairly well-organized movement along lines previously mentioned purporting to give every soldier a chance to return to civil life not as an industrial pensioner but as a skilled workman able to hold his own with the best of his fellow workers. Various governmental and private agencies have been formed and are being formed to teach vocations to returned soldiers, to obtain employment for them and to provide educational, business and agricultural opportunities. The Information and Education Service of the Department of Labor is gathering information on these subjects and is distributing it among the returned soldiers so that they may be brought in touch with all possible opportunities. Manufacturers who desire to aid in this all-important work should communicate with the Inquiry Office of the Department of Labor, 1706 G St. NW., Washington, D. C.

In order to avoid misunderstanding it may be stated that every returned wounded soldier will be retained in the service until he has made as complete recovery as is possible. He will then be restored either to full or limited service or fitted for some self-supporting vocation in civil life as far as medical and educational ability will permit. Wounded soldiers are placed in one of the three following classes: Those who can be returned to full military duty; those who can be fitted for service at home either in military or civil life, and those disabled to the extent of unfitting them for further military service.

By far the greater number fall in Class 1. The second class will be prepared for service at home either in military or civil life, and the vocational training now offered seems varied enough to afford congenial employment in almost every case. The list contains 22 occupations, which includes machine workers, welders and woodworkers, the machine workers probably including inspection of machine parts, which can readily be done by many of the severely crippled. The third class will be rehabilitated physically as far as possible and then given special training, which takes into consideration previous occupation and the extent of the disability. Every man in this class should be urged to avail himself of this opportunity, which can in nearly every case equip him for economic independence.

A Suggestion to Gage and Other Designers

By E. A. Dixie

I have visited a great number of gage and tool shops since the outbreak of hostilities nearly five years ago, and because some of the men think I know something about that kind of work I am often asked how this or that piece should be made, often after the piece has been produced in the most satisfactory manner possible.

These queries are hardly fair. A competent man has perhaps mentally sweated over the problem for hours, days or weeks, and after working out each detail, it is sprung on the unsuspecting visitor, expecting him to make an answer right off the bat.

If a reply is given one of two things is sure to happen —either you are a very wise man for having suggested the way they have found to be satisfactory, or you are a D. F. for suggesting another way or a way they have tried and found valueless.

While there are exceptions the intelligent designer as a rule should and usually does know better than anyone else how the job should be done. If he is an efficient designer he cannot help figuring out how the job is to be handled. If he is an efficient designer he cannot help modifying his design wherever possible to suit manufacturing conditions. This being the case why should this effort be allowed to go to waste?

Take the case of Government work which now occupies the attention of thousands throughout the country. Much of the design of gages and other tools is done by competent men, as stated in the previous paragraph. The blueprints are then sent out broadcast to contractors. In many cases the contractors, though capable of turning out work of the required accuracy, are not familiar with the particular class of work called for in the contract. For instance a firm may specialize on eyelet machines and be called upon by the Government to make gages. It takes the same amount of skill to make eyelet machines and the work demands just as much accuracy as most gage work. But set the average eyelet-machine mechanic at making gages and he would be just as much at sea as the gage maker would be on eyelet machines.

It would require very little extra effort on the part of the designer to outline his ideas of how the job should be done. They could easily be blueprinted and accompany the blueprints of the job. There would be no obligation for the contractor to use the methods thus outlined, but it is almost certain that they would assist him by showing him either how the job should or should not be done with his equipment.

Personals

C. D. Morton has resigned his position as sales engineer of the Page Steel and Wire Co., 30 Church St., New York, to become a captain in the General Engineer's Depot, U. S. A., at Washington.

Charles E. Goodnow, formerly assistant sales manager of the electrical and special wire department of the American Steel and Wire Co. and more recently identified with building construction work in Washington and Brooklyn for the Army and Navy, is now with the Page Steel and Wire Co., 30 Church St., New York. Mr. Goodnow's efforts will be devoted to sales and service on Armco iron welding rods and "Copperweld" electrical wire.

H. C. Elliot has been appointed manager of the Marshall, Huschart Machinery Co.'s branch office in St. Louis, Mo.

George Queich, one of the staff engineers of the International Oxygen Co., 115 Broadway, New York, sailed recently for England to supervise the installation of a 480-cell plant of International Oxygen Co.'s unit oxyhydrogen generators for the British Admiralty.

Phillips Wesley has been appointed manager in charge of the oxyhydrogen plant and sales office of the International Oxygen Co. at Pittsburgh, Penn. The company announces also that **Jack Heller,** for a long time with Z. Heller & Sons, has joined its New York sales force, succeeding **Mr. Barnitz.**

Hugo R. Pausin has resigned as superintendent of the E. W. Bliss Co., Brooklyn, N. Y., to become production manager of the Metropolitan Engineering Co., Brooklyn, N. Y.

Francis J. McGrail, at one time foundry superintendent of the Struthers-Wells Co., Tonawanda, N. Y., is now with the Walker Foundry Co., Erie, Penn., as general superintendent.

W. R. Mullane, for 17 years connected with the Republic Iron and Steel Co. and for the last five years superintendent of its Sylvan Works at Moline, Ill., is now general superintendent of the Sligo Iron and Steel Co., Connellsville, Penn. This is announced by the Commercial Iron and Steel Corporation, 42 Broadway, New York, the new owner of the Sligo Company.

Charles T. Jeffery of Kenosha, Wis., who was president and general manager of the Thomas B. Jeffery Co., has recently been made a superintendent of industrial relations of the United States Shipping Board, Emergency Fleet Corporation, and has been assigned to the Delaware River District.

S. H. MacIntosh, recently of the Cleveland sales office of Manning, Maxwell & Moore, Inc., is now with Cyril J. Bath & Co., Cleveland, dealers in new and second-hand machinery.

E. W. Saunders is now connected with the Federal Tool and Alloy Corporation, 12 Platt St., New York. He will operate in the city of Detroit and in Ohio, with headquarters at Cleveland.

J. A. Murphy, for some time business manager of the Wheeling Electric Co. of Wheeling, W. Va., has become manager of the Wheeling branch of the Hoover Suction Sweeper Co., Canton, Ohio.

William E. Millhouse of Troy, N. Y., has been made general manager of the Burden Iron Co. Mr. Millhouse has been with this company for the past 42 years.

Business Items

Krasberg Engineering and Manufacturing Corporation has taken over the plant, properties and business of the Krasberg Manufacturing Co., and has assumed all its obligations and outstanding contracts and orders, and hereafter all correspondence should be addressed to the new corporation, 536 Lake Shore Drive, Chicago, Ill.

The Independent Pneumatic Tool Co. held a special meeting of the board of directors in Chicago on Oct. 30, and appointed Roger E. Sullivan a director and elected him chairman of the board, also a member of the executive committee to fill the vacancy caused by the death of the late John P. Hopkins.

The Federal Tool and Alloy Steel Corporation and **Swedish Iron and Steel Corporation** have been consolidated under the name of Federal Tool and Alloy Steel Corporation, with general offices at 12 Platt St., New York, and with branches in Chicago, Cleveland and New Orleans. Thomas Towne is first vice president and general manager.

The National Electric and Welding Co., 90 West St., New York, has been appointed New York sales agent for the C. & C. Electric and Manufacturing Co. and also Eastern sales agent for the Wesche Electric Co., Cincinnati, Ohio. The personnel formerly connected with the New York sales office of the C. & C. Electric and Manufacturing Co. is now handling both C. & C. and Wesche machinery, the line of apparatus having been extended to include alternating and direct current equipment, arc welders, etc.

The Turner Machine Co., Danbury, Conn., has purchased the business of A. D. Quirt, Hartford, Conn., including its good-will, drawings, patterns, tools, all equipment and the patents, and will continue the manufacture of the Quirt line of turret machines in addition to its own line of turner turrets.

The Hoover Steel Ball Co., Ann Arbor, Mich., at its recent annual meeting of stockholders elected Walter C. Mack, president to succeed President L. J. Hoover, deceased. F. A. Stivers was elected vice president, M. J. Fritz, treasurer, H. D. Runciman, secretary and manager, and William Arnold, Jr., assistant secretary.

The Modern Tool and Machine Works, formerly at 176 Worth Street, New York, have moved to 344 Mulberry St., Newark, N. J.

Obituary

Sherman Bougher, secretary of the J. W. Paxson Co., Philadelphia, Penn., died Oct. 28, 1918

Paul H. Cordes, first lieutenant of Company C, Thirtieth Engineers, was killed in action, Sept. 12 on the western front. Lieutenant Cordes was 31 years old. He had been in the employ of the Worthington Pump and Machinery Corporation for the last five years, holding the position of sales engineer in the Chicago office. His death will be regretted by his many friends and by his employers in civil life, who speak very highly of his loyal and efficient service.

Frank I. Parker, since 1906 associated with the Cutler-Hammer Manufacturing Co., Milwaukee, Wis., died of pneumonia Oct. 18, 1918. He was a member of the American Institute of Electrical Engineers.

Ralph A. Walters, for 12 years with the American Bridge Co. and later superintendent of construction of the Neville Island gun and projectile plant of the Ordnance Department, United States Steel Corporation, died at Pittsburgh, Oct. 20, 1918.

Trade Catalogs

Wetmore Expanding Reamers. Wetmore Mechanical Laboratory Co., Milwaukee, Wis. Leaflet No. 53. Pp. 2; 8½ x 11 in. This leaflet describes Wetmore expanding reamers made for finish-sizing the fuse of United States Army shells and British high-explosive shells. Reamers for both shells are illustrated. It also gives illustrates and a description of extra blades for these reamers.

Clover Grinding Compounds. Clover Manufacturing Co. Booklet. Pp. 8; 3½ x 7 in. Describing something of the growth of the business and giving an illustration of the Clover plant. It also mentions some uses and suggests some grades.

Carry On!

The editorial supplement accompanying this issue is to call the attention of all employers and employees in machine shops to the fact that we must "carry on" in peace as well as in war. There is a vast amount of work to do—*for all—now*—and in the times to come.

New Publications

Fuel Economy in Boiler Rooms.—By A. R. Maujer and Charles H. Bromley, of the Editorial Staff of *Power*. Second edition; 302 5½ x 8 in. pages; 64 illustrations. Published by the McGraw Hill Book Co., Inc., 239 West 39th St., New York. Price, $2.50 net.

This book was originally published under the title of "Fuel Economy and CO_2 Recorders," but in the preparation of the second edition it was deemed necessary to broaden the scope of the work and to change the title to "Fuel Economy in Boiler Rooms." The new title is more truly indicative of the contents. The book is not a handbook; it is not intended to treat of design, though correct furnace design is mentioned and illustrated to guide the boiler-room crew or superintendent. Though intended primarily for the student, the fireman and power-plant operating engineer, the consulting engineer will find it useful. It is published in two parts. Part I, Fuel Economy and CO_2 Recorders, Chapters I to XI, take up the principles of combustion, analysis of coal, flue-gas analysis, heat lost in flue gases, draft and its measurements, chimney design, evaporation, boiler efficiency, heat balance, feedwater treatment, CO_2 recorders. Part II, Fuel Economy in Boiler Rooms, Chapters I to VIII, treats of fuels, combustions of coal in boiler furnaces, boiler settings, hand-firing soft coal, burning fuel oil under boilers, etc.

Forthcoming Meetings

The American Society of Mechanical Engineers will hold its annual meeting in New York, Dec. 3-6. The secretary is Calvin W. Rice, 29 West 39th St., New York.

Boston Branch National Metal Trades Association. Monthly meeting on first Wednesday of each month. Young's Hotel. Donald H. C. Tullock, Jr., secretary. Room 41, 166 Devonshire St., Boston, Mass.

The Chamber of Commerce of the United States will sponsor a big convention of war-service committees in Atlantic City, N. J., Nov. 19 to 21, 1918. The following classes of manufacturers will be represented: Gear, wire fencing, jute, store fixture, furniture, textile machinery, foundry equipment, sporting gun and ammunition, warm-air register, furnace, metal hospital furniture, ladder, laundering machinery, naval stores, oil refining and lard substitute, textile pin, safety pin, water-purification apparatus, dandy rolls, stereopticon machine, power pump, gasoline and kerosene vapor lamp, fluorspar, egg case and egg filler, chuck, automatic office device, bobbin and shuttle, germicide and insecticide, clay, oil cloth, bottle and jar cap, brush, button, sensitized photograph paper, tent and awning.

Engineers' Society of Western Pennsylvania. Monthly meeting, third Tuesday; section meeting, first Tuesday. Elmer K. Hiles, secretary, Oliver Building, Pittsburgh, Penn.

New England Foundrymen's Association. Regular meeting, second Wednesday of each month. Exchange Club, Boston, Mass. Fred F. Stockwell, 205 Broadway, Cambridgeport, Mass.

The New York State Industrial Safety Congress will hold its third annual session at the Hotel Onondaga, Syracuse, N. Y., Dec. 2-5. Particulars may be obtained from Louis Wiard, 230 Fifth Ave., New York.

Philadelphia Foundrymen's Association. Meeting first Wednesday of each month. Manufacturers' Club, Philadephia, Penn., Howard Evans, secretary, Pier 45, North Philadelphia, Penn.

Providence Engineering Society. Monthly meeting fourth Wednesday of each month. A. E. Thornley, corresponding secretary, P. O. Box 796. Providence, R. I.

Rochester Society of Technical Draftsmen. Monthly meeting, last Thursday. O. L. Angevine, Jr., secretary, 857 Genesee St., Rochester, N. Y.

Superintendents' and Foremen's Club of Cleveland. Monthly meeting, third Saturday. Philip Frankel, secretary, 310 New England Building, Cleveland, Ohio.

Technical League of America. Regular meeting, second Friday of each month. Oscar S. Teale, secretary, 240 Broadway, New York.

Western Society of Engineers, Chicago, Ill. Regular meetings, first, second, third and fourth Mondays of each month, except July and August. Edgar S. Nethercut, secretary, 1735 Monadnock Block, Chicago, Ill.

WEEKLY PRICE GUIDE OF

IRON AND STEEL

PIG IRON—Quotations compiled by The Matthew Addy Co.:

	Current	One Month Ago
CINCINNATI		
No. 2 Southern	$37.60	$37.60
Northern Basic	34.80	34.80
Southern Ohio No. 2	35.80	35.80
NEW YORK, Tidewater delivery		
Penna. 2X	39.55	39.15
Virginia No. 2	41.70	41.70
Southern No. 2	41.70	41.70
BIRMINGHAM		
No. 2 Foundry	34.00	34.00
PHILADELPHIA		
Eastern Pa. 2X	39.15	38.85*
Virginia No. 2	40.50	40.50†
Basic	36.90	36.60*
Grey Forge	36.90	36.60*
Bessemer	39.10	38.80*
CHICAGO		
No. 2 Foundry Local	34.50	34.50
No. 2 Foundry Southern	39.00	39.00
PITTSBURGH, including freight charge from the Valley		
No. 2 Foundry Valley	35.40	35.40
Basic	34.40	34.40
Bessemer	36.60	36.60

* F.o.b. furnace. † Delivered.

STEEL SHAPES—The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and larger, and plates ¼ in. and heavier, from jobbers' warehouses at the cities named:

	New York			Cleveland		Chicago	
	Current	One Month Ago	One Year Ago	Current	One Year Ago	Current	One Year Ago
Structural shapes	$4.245	$4.245	$5.25	$4.17	$5.00	$4.27	$5.00
Soft steel bars	4.145	4.145	5.00	4.07	4.50	4.17	4.50
Soft steel bar shapes	4.145	4.145	5.00	4.17	4.50	4.17	4.50
Soft steel bands	4.745	4.995	.....	.....	.....	.....	.....
Plites, ¼ to 1 in. thick	4.495	4.495	10.00	4.42	7.00	4.25	9.00

BAR IRON—Prices per 100 lb. at the places named are as follows:

	Current	One Year Ago
Pittsburgh, mill	$3.50	$4.75
Warehouse, New York	4.75	4.75
Warehouse, Cleveland	4.67	4.95
Warehouse, Chicago	4.10	4.50

STEEL SHEETS—The following are the prices in cents per pound from jobbers' warehouse at the cities named:

	New York				Cleveland		Chicago	
	Pittsburgh, Mill, in Carloads	Current	One Month Ago	One Year Ago	Current	One Year Ago	Current	One Year Ago
*No. 28 black	5.00	6.52	6.495	6.445	6.42	5.75	6.52	6.445
*No. 26 black	4.90	6.42	6.395	6.405	6.32	5.65	6.42	6.405
*Nos. 22 and 24 black	4.85	6.37	6.345	6.295	6.27	5.60	6.37	6.295
Nos. 18 and 20 black	4.80	6.32	6.295	6.245	6.22	5.55	6.32	6.245
No. 16 blue annealed	4.45	5.72	5.695	5.645	5.62	5.20	5.72	5.645
No. 14 blue annealed	4.35	5.62	5.595	5.545	5.52	5.10	5.62	5.545
No. 10 blue annealed	4.25	5.42	5.495	5.445	5.42	5.00	5.52	5.445
*No. 28 galvanized	6.25	7.77	7.745	7.695	7.67	7.00	7.77	7.695
*No. 26 galvanized	5.95	7.47	7.445	7.395	7.37	6.70	7.32	7.395
No. 24 galvanized	5.80	7.32	7.295	7.245	7.22	6.55	7.47	7.245

* For painted corrugated sheets add 30c. per 100 lb. for 25 to 28 gage; 25c. for 19 to 24 gages; for galvanized corrugated sheets add 5c., all gages.

COLD DRAWN STEEL SHAFTING—From warehouse to consumers requiring at least 1000 lb. of a size (smaller quantities take the standard extras) the following discounts hold:

	Current	One Year Ago
New York	List plus 13%	List plus 25%
Cleveland	List plus 11%	List
Chicago	List plus 13%	List plus 10%

DRILL ROD—Discounts from list price are as follows at the places named:

	Extra	Standard
New York	35%	40%
Cleveland	35%	40%
Chicago	35%	40%

SWEDISH (NORWAY) IRON—The average price pr 100 lb., in ton lots is:

	Current	One Year Ago
New York	$15.50-19	$14.00
Cleveland	20.00	15.00
Chicago	19.00	13.50

In coils an advance of 50c. usually is charged.
Note—Stock very scarce generally.

WELDING MATERIAL (SWEDISH)—Prices are as follows in cents per pound f.o.b. New York, in 100 lb. lots and over:

Welding Wire*		Cast-Iron Welding Rods	
½, 11, 5/32, ¼, 5/16, 3/8, No. 8, 7/16 and No. 10	22.10 to 33.00	½ by 12 in. long	16.00
½		½ by 19 in. long	14.00
No. 12		¾ by 19 in. long	12.00
5/32, No. 14 and ¼		1 by 21 in. long	12.00
No. 18			
No. 20			

* Very scarce.

* Special Welding Wire

½	33.00
¾	30.00
1	38.00

MISCELLANEOUS STEEL—The following quotations in cents per pound are from warehouse at the places named:

	New York Current	Cleveland Current	Chicago Current
Tire	4.14	4.07	4.17
Toe calk	5.75	4.65	4.32
Openhearth spring steel (heavy)	8.00	8.00	7.50
Spring steel (light)	11.00	11.25	11.75
Coppered bessemer rods	9.00	8.00	7.07
Hoop steel	4.77	4.75	4.77
Cold-rolled strip steel	8.02	8.25	8.57
Floor plates	6.27	6.00	6.25

PIPE—The following discounts are for carload lots f.o.b. Pittsburgh; basing card of Nov. 6, 1917, for steel pipe and for iron pipe:

BUTT WELD

Steel Inches	Black	Galvanized	Iron Inches	Black	Galvanized
⅛, ¼, and ⅜	44%	17½%	⅛ to 1¼	33%	17%
½	48%	33½%			
¾ to 3	51%	37½%			

LAP WELD

2	44%	31½%	2	26%	12%
2½ to 6	47%	34½%	2½ to 4	28%	15%
			4½ to 6	28%	15%

BUTT WELD. EXTRA STRONG PLAIN ENDS

⅛, ¼ and ⅜	40%	22½%	½ to 1¼	33%	18%
½	45%	32½%			
¾ to 1¼	49%	36½%			

LAP WELD. EXTRA STRONG PLAIN ENDS

2	42%	30½%	2	27%	14%
2½ to 4	45%	33½%	2½ to 4	29%	17%
4½ to 6	44%	32½%	4½ to 6	28%	16%

Stock discounts in cities named are as follows:

	New York Black	New York Galvanized	Cleveland Black	Cleveland Galvanized	Chicago Black	Chicago Galvanized
⅛ to 3 in. steel butt welded	40%	28%	41%	26%	41.1%	26.1%
3½ to 3 in. steel lap welded	36%	25%	37%	23%	37.1%	23.1%

Malleable fittings. Class B and C, from New York stock sell at list+15%. Cast iron, standard sizes, 5% off.

METALS

MISCELLANEOUS METALS—Present and past New York quotations in cents per pound, in carload lots:

	Current	One Month Ago	One Year Ago
Copper, electrolytic	26.00*	26.00	23.50
Tin in 5-ton lots	78.50	83.00	74.00
Lead	8.05	8.55	7.25
Spelter	9.20	9.50	7.88

* Government price.

ST. LOUIS

Lead	7.75	8.25	7.13
Spelter	8.85	9.25	7.63

At the places named, the following prices in cents per pound prevail, for 1 ton or more:

	New York			Cleveland		Chicago	
	Current	One Month Ago	One Year Ago	Current	One Year Ago	Current	One Year Ago
Copper sheets, base	38.00	38.00	35.00	38.00	36.00	38.00	35.00
Copper wire (carload lots)	35.00	35.00	38.50	35.00	32.00	38.00	33.00
Brass sheets	39.75	39.75	40.00	40.50	35.00	38.00	35.00
Brass pipe	46.00	46.00	43.00	42.50	42.00	44.00	42.00
Solder (half and half) (case lots)	58.00	58.00	39.25	50.50	40.00	65.00	38.00

Note:—Solder very scarce.

Copper sheets quoted above hot rolled 16 oz., cold rolled 14 oz. and heavier, add 1c.; polished takes 1c. per sq.ft. extra for 20-in. widths and under; over 20 in., 2c.

BRASS RODS—The following quotations are for large lots, mill. 100 lb. and over, warehouse; 25% to be added to mill prices for extras; 50% to be added to warehouse price for extras:

	Current	One Year Ago
Mill	$37.75	$29.00
New York	34.25	30.00
Cleveland	38.50	34.00
Chicago	29.50	37.00

SHOP MATERIALS AND SUPPLIES

ZINC SHEETS—The following prices in cents per pound prevail:

Carload lots f.o.b. mill 15.00

	In Casks		Broken Lots	
	Current	One Year Ago	Current	One Year Ago
Cleveland	18.75	20.00	18.40	20.50
New York	17.00	21.00	17.50	21.25
Chicago	22.00	21.00	21.50	21.50

ANTIMONY—Chinese and Japanese brands in cents per pound, in ton lots, for spot delivery, duty paid:

	Current	One Year Ago
New York	13.50	14.00
Chicago	15.50	16.25
Cleveland	16.00	16.00

OLD METALS—The following are the dealers' purchasing prices in cents per pound:

	New York		Cleveland		
	Current 1918	One Year Ago	Current 1918	One Year Ago	Chicago
Copper, heavy and crucible	24.00	22.00	24.00	21.00	21.50
Copper, heavy and wire	22.00	21.00	23.50	21.00	21.00
Copper, light and bottoms	20.50	19.00	21.50	20.00	21.00
Lead, heavy	7.50	4.75	.....	5.50	6.50
Lead, tea	6.00	4.00	7.50	4.50	6.20
Brass, heavy	14.00	15.00	16.50	14.00	21.00
Brass, light	11.00	10.50	12.50	11.00	12.50
No. 1 yellow brass turnings	14.00	16.00	14.00	15.00	15.00
Zinc	6.50	5.75	6.00	5.50	5.50

ALUMINUM—The following prices are from warehouse at places named:

	New York	Cleveland	Chicago
No. 1 aluminum, guaranteed over 99% pure, in ingots for remelting (1-15 ton lots), per lb	33.20c.	32.30c.	33½c.

This is the Government price for lots of from 1 to 14 tons.

COPPER BARS from warehouse sell as follows in cents per pound, for ton lots and over:

	Current	One Year Ago
New York	32.00	40.00
Chicago	38.00	40.00
Cleveland	36.50	39.00

BABBITT METAL—Warehouse price per pound:

	New York		Cleveland		Chicago	
	Current	One Year Ago	Current	One Year Ago	Current	One Year Ago
Best grade	95.00	70.00	93.00	80.00	96.00	70.00
Commercial	50.00	40.00	23.00	21.00	25.00	25.00

SHOP SUPPLIES

NUTS—From warehouse at the places named, on fair-sized orders, the following amount is deducted from list:

	New York		Cleveland		Chicago	
	Current	One Year Ago	Current	One Year Ago	Current	One Year Ago
Hot pressed square	$2.50*	List	$1.25	$1.30	$0.98	$2.00
Hot pressed hexagon	2.50*	List	1.05	1.30	.78	2.00
Cold punched hexagon	2.50*	List	.75	List	1.00	1.50
Cold punched square	2.50*	List	.75	List	1.00	1.50

* List plus.

Semi-finished nuts sell at the following discounts from list price:

	Current	One Year Ago
New York	40%	50%
Chicago	50%	45%
Cleveland	50+10%	50%

MACHINE BOLTS—Warehouse discounts in the following cities:

	New York	Cleveland	Chicago
¾ by 4 in. and smaller	30%	40+10%	37%
Larger and longer up to 1 in. by 30 in.	15%	20+ 5%	25—5%

WASHERS—From warehouses at the places named the following amount is deducted from list price:

For wrought-iron washers:

New York ..... $2.50 Cleveland ..... List Chicago $2.50

For cast-iron washers the base price per 100 lb. is as follows:

New York ..... $5.00 Cleveland ..... $4.25 Chicago $4.50

CARRIAGE BOLTS—From warehouses at the places named the following discounts from list are in effect:

	New York	Cleveland	Chicago
¾ by 4 in. and smaller	30%	45%	32½%
Larger and longer up to 1 in. by 30 in	15%	20+5%	20%

COPPER RIVETS AND BURS sell at the following rate from warehouse:

	Rivets		Burs	
	Current	One Year Ago	Current	One Year Ago
Cleveland	List plus 10%	List plus 10%	List plus 10%	List plus 10%
Chicago	List price	List price	List plus 20%	List price
New York	20% from list	List plus 10%	List plus 20%	10-2½% from list

RIVETS—The following quotations are allowed for fair-sized orders from warehouse:

	New York	Cleveland	Chicago
Steel ½ and smaller	30%	45—5%	40%
Tinned	30%	45—5%	40%

Button heads, ½, ¾, 1 in. diameter by 2 in. to 5 in. sell as follows per 100 lb.

New York...$5.675 Cleveland...$5.15 Chicago...$5.67 Pittsburgh...$4.65

Coneheads, same sizes:

New York...$5.775 Cleveland...$5.25 Chicago...$5.77 Pittsburgh...$4.75

MISCELLANEOUS

SEAMLESS DRAWN TUBING—The base price in cents per pound from warehouse in 100-lb. lots is as follows:

	New York	Cleveland	Chicago
Copper	51.00	38.00	39.50
Brass	42.00	40.00	44.00

For immediate stock shipment 3c. is usually added. The prices of course vary with the quantity purchased. For lots of less than 100 lb., but not less than 75 lb., the advance is 1c.; for lots of less than 75 lb., but not less than 50 lb., the advance is 2½c. over base (100-lb. lots); for less than 50 lb. but not less than 25 lb., 5c. should be added to the base price; and for quantities under 25 lb. the increase above base is 10c.

TIN PLATES—Warehouse prices per box:

Coke tin plate, 14 x 20:

	Cleveland		Chicago	
	Current	One Yr. Ago	Current	One Yr. Ago
100 lb	$9.17½	$12.00	$10.60	$11.75
I. C. 107 lb	9.42½	12.17½	10.70	11.90

Terne plate, 20 x 28:

Base Weight	Net Weight	Coating				
100 lb.	200	3	18.95	18.95	19.10	17.90
I. C.	214	8	19.25	19.25	19.40	18.25
I. C.	270	8	21.75	21.75	21.40	20.35
I. C.	218	12	21.75	21.75	22.60	19.25
I. C.	221	15	22.50	22.50	22.10	19.50
I. C.	226	30	23.25	23.25	22.60	20.50
I. C.	231	25	24.50	24.50	23.10	21.30
I. C.	236	30	25.75	25.75	23.60	22.25
I. C.	241	35	26.75	26.75	25.10	23.25
I. C.	246	40	28.00	28.00	25.60	24.55

NOTE—New York prices furnished on application to dealers. Price varies according to whether the plates are wanted for work essential to the war or for nonessential work.

COTTON WASTE—The following prices are in cents per pound:

	New York			
	Current	One Year Ago	Cleveland	Chicago
White	11.00 to 13.00	13.00	16.50	12.00 to 16.50
Colored mixed	8.50 to 12.00	12.00	13.00	11.50 to 14.00

WIPING CLOTHS—Jobbers' price per 1000 is as follows:

	13½ x 13½	13½ x 20½
Cleveland	52.00	58.00
Chicago	48.00	50.00

SAL SODA sells as follows per 100 lb.:

	Current	One Month Ago	One Year Ago
New York	$1.75	$1.75	$1.75
Philadelphia	1.75	1.75	1.75
Cleveland	2.40	2.40	2.10
Chicago	2.00	2.00	2.00

ROLL SULPHUR in 360-lb. bbl. sells as follows per 100 lb.:

	Current	One Month Ago	One Year Ago
New York	$4.30	$4.30	$4.30
Cleveland	4.60	4.60	4.50
Chicago	4.00	4.00	3.80

COKE—The following are prices per net ton at ovens, Connellsville, and cover the past four weeks:

	Oct. 31	Oct. 24	Oct. 17	Oct. 10	Oct. 3
Prompt furnace	$6.00	$6.00	$6.00	$6.00	$6.00
Prompt foundry	7.00	7.00	7.00	7.00	7.00

FIRE CLAY—The following prices prevail:

		Current
Chicago	450-lb. bbl.	$2.50
Cleveland	375-lb. bag	2.50

LINSEED OIL—These prices are per gallon:

	New York		Cleveland		Chicago	
	Current	One Year Ago	Current	One Year Ago	Current	One Year Ago
Raw in barrels	$1.61	$1.20	$1.90	$1.22	$1.75	$1.18
5-gal. cans	1.76	1.30	2.00	1.35	1.95	1.28

WHITE AND RED LEAD in 500-lb. lots sells as follows in cents per pound:

	Red				White	
	Current		1 Year Ago		Current	1 Year Ago
	Dry	In Oil	Dry	In Oil	Dry and In Oil	Dry and In Oil
100-lb. keg	14.00	14.50	12.25	12.50	14.00	12.50
25 and 50-lb. kegs	14.25	14.75	12.50	12.75	14.25	12.25
12½-lb. keg	14.50	15.00	12.75	13.00	14.50	12.50
5-lb. cans	.....	.....	14.25	14.00	16.00	14.50
1-lb. cans	.....	.....	14.25	14.50	17.00	14.50

NEW *and* ENLARGED SHOPS

Consult the Buying Section when in need of machinery or supplies

WASHINGTON, D. C.

The Navy aims to give information regarding its purchases to all manufacturers known to be in a position to supply its demand. Owing to the need of prompt action in the cases of all machine tools hereinafter listed, the Navy cannot arrange to permit a postponement of the opening of bids if the manufacturers are able to secure bidding forms and submit their bids prior to date fixed for opening.

In case time does not permit this, it will be appreciated if any manufacturer not receiving information directly regarding these purchases will notify the Purchasing Division, Bureau of Supplies & Accounts, Navy Department, Washington, D. C., in order that the firm's name may be properly listed for all future purchases.

The Bureau of Supplies and Accounts, Navy Department, will soon receive bids for furnishing machines and machine tools as follows:

Schedule No. 6677½, machine tools, including 1 grinder, 1 drilling hammer and 1 sander, delivery San Francisco, Calif.

Schedule No. 6754½, 1 milling machine, delivery Norfolk, Va.

Schedule No. 6810½, 1 brake and folder forming machine and 1 slitting shears.

Schedule No. 6785½, 1 bench lathe, delivery Norfolk, Va.

Schedule No. 6787½, 2 wheel grinders, delivery Key West, Fla.

Schedule No. 6814½, 1 wood, ball-bearing shaper, delivery Norfolk, Va.

Schedule No. 6818½, 2 band saw setting and sharpening machines, delivery Brooklyn, N. Y.

Schedule No. 6840½, 1 drill head, delivery Newport, R. I.

Schedule No. 6802½, 1 shear and punch, 1 sheet metal forming machine and sheet metal brake.

Schedule No. 6803½, 1 bench grinder, delivery Washington, D. C.

Schedule No. 6783½, 1 sensitive drill, delivery Washington, D. C.

Schedule No. 6786½, 2 precision lathes, delivery Washington, D. C.

Schedule No. 6788½, 2 sensitive drills, delivery Washington, D. C.

Schedule No. 6822½, 8 vertical drills, delivery Brooklyn, N. Y.

Schedule No. 6885½, miscellaneous wiring, grooming shearing and turning machines, delivery Boston, Mass.

Schedule No. 6898½, hack saw blades, delivery Philadelphia, Penn.

Schedule No. 6905½, miscellaneous equipment for machine tools.

Schedule No. 6907½, 1 rip, self feed saw, delivery Norfolk, Va.

Schedule No. 6847½, 2 drill grinding machines, delivery Washington, D. C.

Schedule No. 6924½, 1 single surface cylinder, 5 pattern vises, 1 wood trimmer, 1 boring and 1 grinding machine, 1 disc sander, 1 double end wood turning lathe, 1 speed lathe and 1 planer and jointer.

Schedule No. 6894½, 1 rotary shear, delivery Norfolk, Va.

Schedule No. 6895½, 8 vertical shapers, delivery Brooklyn, N. Y.

Schedule No. 6896½, 1 bearing type miller, 1 grinder tool machine, 1 engine lathe and 3 lathe tool sets, delivery f.o.b.

Schedule No. 6938½, tools, cutters, saws, etc., delivery Hampton Roads, Va.

Schedule No. 6940½, 1 table combination saw, delivery Norfolk, Va.

Schedule No 6913½, 6 bench type drills, delivery Philadelphia, Penn.

Schedule No. 6962½, 1 machine crank pin, delivery Norfolk, Va.

The Bureau of Supplies and Accounts, Navy Department, will receive bids for furnishing machines and machine tools as follows:

Nov. 15—Schedule No. 6770½, 1 squaring machine, delivery Philadelphia, Penn.

Schedule No. 6784½, 2 bench lathes and tools, delivery Newport, R. I.

Nov. 22—Schedule No. 6938½, tools, cutters, saws, etc., delivery Hampton Roads, Va.

METAL WORKING

NEW ENGLAND STATES

Conn., Bridgeport—The Heppenstall Forge Co., Howard Ave., will build a 1-story, 60 x 135 ft. casting shop. Estimated cost, $25,000.

Mass., Athol—The Union Twist Drill Co., 70 Monroe St., is building a 2-story, 30 x 60 ft. addition to its plant.

Mass., Westfield—The Westfield Manufacturing Co., Cycle Ave., manufacturer of bicycles and motor cycles, has had plans prepared by M. B. Harding, Arch., 97 Elm St., for the erection of a 1-story, 43 x 185 ft. and 24 x 64 ft. storehouse and shop. Estimated cost, $33,000.

MIDDLE ATLANTIC STATES

D. C., Washington—A. L. Flint, General Purchasing Officer of the Panama Canal, Washington, D. C., will receive bids until Nov. 21 (change of date), for furnishing machine shop equipment at the Isthmus of Panama. Noted Nov. 7.

D. C., Washington—Bids will be received by the General Supplies Division, Office of the Director of Purchases, Munitions Bldg., Potomac Park, for miscellaneous machine tools, Section 1 C. J. Bertram, Room 3806, Buyer; Section B, O. A. Lanchantin, Room 3815, Buyer; Section 3 A. J. E. Deimer, Room 3814, Buyer.

Md., Baltimore—The Guilford Motor Co., York Rd. near Arlington Ave., has awarded the contract for the erection of a 1-story, 100 x 200 ft. addition to its garage.

Md., Mount Clare (Baltimore P. O.)—The Baltimore & Ohio R. R., Baltimore and Ohio Bldg., has awarded the contract for the erection of a 1-story 90 x 240 ft. machine shop here on Gilmor St. Estimated cost, $200,000. The company will require machinery and machine tools. H. A. Lane, Baltimore, Ch. Engr.

N. J., Camden—The R. H. Beaumont Co., Drexel Bldg., Philadelphia, Penn., manufacturer of conveyors, etc., has awarded the contract for the erection of a 50 x 200 ft. plant on 24th St. Estimated cost, $25,000. Noted Sept. 19.

N. J., Camden—Fire recently destroyed the plant of the Broadway Auto Sheet Metal Co., 812 Broadway, with a loss of about $10,000.

N. J., Camden—Fire recently destroyed the pattern shop of the Camden Iron Works, Ringgold St. Loss, $50,000.

N. J., Camden—The New York Shipbuilding Co., Broadway and Fairview Ave., has awarded the contract for the erection of a 1-story garage. Estimated cost, $40,000.

N. J., Jersey City—J. McWilliams & Son, 372 Sip Ave., manufacturer of hardware specialties, has had plans prepared for the erection of a 1-story forge shop addition to its plant. Estimated cost, $8800.

N. J., Newark—The Butterworth Judson Corporation, Ave. R, plans to install a large quantity of new nitrating equipment in its plant to replace the chemical stoneware now in use.

N. J., Newark—The Gulf Refining Co., Plum Point Lane, is building a 65 x 100 ft. reinforced concrete automobile repair and paint shop at 92-100 Lentz Ave. Estimated cost, $10,000.

N. J., Newark—The Heller Bros. Co., Verona and Mt. Prospect Ave., manufacturer of files, rasps, etc., has awarded the contract for the erection of a 1-story, 10 x 109 ft. brick addition to its foundry. Alterations will be made to the other foundry buildings. Estimated cost, $8000.

N. J., Plainfield—The Standard Aircraft Co., North Ave., is remodeling and improving its plant. Estimated cost, $350,000.

N. J., South Amboy—The Raritan River R. R., 15 East 4th Place, has awarded the contract for the erection of a machine shop, a 12 stall roundhouse, a power house and a storehouse. Estimated cost, $196,490. T. Filskov, ch. engr.

N. Y., Auburn—The Crucible Steel Co. of America, 104 Magnolia St., Syracuse, has acquired the plant of the Cayuga Tool Steel Co., here, and plans to build 3 new additions to same.

N. Y., Buffalo—The Aluminum Castings Co., 2800 Harvard Ave., Cleveland, Ohio, has awarded the contract for a 3-story laboratory, to be erected here, at 1850 Elmwood Ave. Estimated cost, $20,000.

N. Y., Buffalo—The Buffalo Dry Dock Co., Ganson St., is having plans prepared by C. C. Hauck, Arch., for an extension to its punch shop. Estimated cost, $20,000. Noted Aug. 22.

N. Y., Buffalo—The Harvey Haines Machine Co., 369 Ellicott St., has increased its capital stock from $5000 to $25,000; the proceeds will be used for extensions to its plant.

N. Y., Buffalo—F. G. Kroner, 527 Marine Bank Bldg., has had plans prepared for remodeling and equipping its plant on West Ferry St., for the manufacture of machine parts. Noted Nov. 7.

N. Y., Buffalo—The Sterling Engine Corporation, 1250 Niagara St., manufacturer of mammoth gasoline motors, has had plans prepared for the erection of a brick addition to its plant. Estimated cost, $1000. Noted Oct. 17.

N. Y., New York (Borough of Brooklyn)—The Bureau of Yards & Docks, Navy Department, Washington, D. C., has awarded the contract for the erection of a garage at the supply base in South Brooklyn. Estimated cost, $33,187.

N. Y., New York (Borough of Manhattan)—The city has awarded the contract for an extension to its repair shop on Lenox Ave. and 149th St. Estimated cost, $200,000. Noted Oct. 31.